THE

Practical Teacher

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'*Knowledge is proud that he has learned so much,*
Wisdom is humble that he knows no more.'—COWPER.

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Hygiene.

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SEWER VENTILATION.

THE principles which should guide an authority in ventilating sewers and house drains have been already enunciated. If sewers are properly constructed, if they are not elongated cesspools, if they flush clean, and if the arrangements for flushing are such as compel the scouring of the sides and invert of the arch at periodical intervals, sewer-gas will never be produced in sufficient quantities to require more than natural means for its removal—the natural means being the extension of every soil-pipe in an upward and straight line to some point above the eaves of the house, or the highest wall in proximity to it; a proper arrangement of ventilating shafts at every junction with main sewers; and frequent lampholes, so that the whole area of underground pipes may be visually examined. Smells from sewers ought not to exist, except such as belong to the w.c. itself, which cannot be avoided; these are not hurtful, and are easily dissipated by ventilation. Sewer-gas when of a dangerous quality arises in consequence of stagnation, which allows time for fermentation to take place, the latter being promoted by the presence of living organisms, which luxuriate in darkness and in atmospheres which are not normal, but depreciated in quality. All plans for the ventilation of sewers, which aim at diminishing the incidence of gaseous products from sewers in particular places, are make-shifts, and unworthy of the attention of good engineers. I do not propose to consider these plans here. If, in consequence of faulty work, a trap of any kind has to be placed on a sewer for the protection of an individual house, there should be a ventilator for the protection of that trap. Water-traps will not protect against the possible evils of sewer air if there is any chance of a pressure equal to a difference of even a quarter of an inch on either side of the trap. This difference will frequently arise from meteorological changes alone. It is by such changes that natural ventilation is kept up. The law which regulates the diffusion of gases, the difference of densities consequent upon the changes of temperature in the air itself, the alterations of level from the irregular flow of sewage in the sewer, and the changes which arise from the tension of vapour in the air as compared with the outside atmosphere, will keep up the movement of air in the sewer and prevent stagnation. The latter is always to be avoided in connection with the removal of filth. '*Move on*' applies to the air in sewers as well as to the sewage. If there are numerous communications with the outer air, if there is a sufficient water-supply, if there are inlets for air in the public streets, and outlets at every soil-pipe, which must extend above the level of the house-top, there will never be any stagnation of air in the house-drain or in the sewers themselves. Intercepting-traps may be necessary in those districts in which an engineer has been employed who has not properly supervised his work, but the more numerous they are, the greater the indication of want of ability on the part of the official, whose duty it is to prevent the formation of sewer-gas. There is a frequent outcry against ventilators being placed on the level of the street, but in well-constructed sewers they should be inlets for fresh air, and not outlets for foulness.

It is a mistake to clog them with charcoal-baskets if the sewer is well made; whilst if it is not so, the charcoal will act for a day or two, but no longer; its presence then impedes ventilation, and adds to the evil by assisting stagnation.

The principles adopted by Nature in ventilating a tree, and which promotes circulation of both liquids and gases, raising the former to the topmost twig without artificial means, are the principles which should guide an engineer in ventilating his sewers.

Deodorisers, Antiseptics, and Disinfectants.—These agents are closely connected with sewer-gas and septic organisms as bane and antidote. A great deal of misconception has existed as to their power, and much ignorance shown in using them for the purposes of disease repression.

It is necessary to have clear views upon the subject, and to consider the means by which the object is to be attained. Let us inquire as to the object. It is twofold. (1) To remove objectionable smell—a course which is frequently thought to be the principal point, but which is very secondary to (2) the destruction of the causes which have produced the smell, and which may spread disease. Stinks alone need not be disease-producers.

BRITISH MUSEUM

Deodorants are used for the first purpose. They may be pleasant to the senses, such as eau de Cologne, which simply covers up one smell by making another. It is true that other may further oxidation by promoting the formation of ozone, but this work is comparatively trivial, and as oxidisers as ordinarily used they have little power in that direction.

Simple Deodorants are camphor, tobacco fumes, eau de Cologne, various patented articles which are more valuable to the patentees, from the financial returns which they bring, than in sick chambers. In cases in which it is advantageous and decidedly comfortable to remove a nauseous smell as quickly as possible, we have, first and foremost, aerial ventilation, and second, when this cannot be efficiently performed, incensing by means of burning woods and resins, such as were in vogue in the middle ages, and were recommended as religious rites by the priests and monks of those times. A very simple, and at the same time a very efficacious method for use in a sick room, is to take a few live coals upon a fire-shovel, out of a clear coke fire, and sprinkle half an ounce of ground coffee over the coals, allowing the fumes from the burning coffee to escape into the apartment. It is thoroughly effectual in removing the offending smell. The old nurse uses smouldering brown paper for the same purpose, but the burning coffee is, if thoroughly done, a most pleasant way of incensing a sick-room and removing the smell which may arise from stinking excreta, and it is only in such cases that deodorants are allowable. They are useless elsewhere.

Disinfectants and Antiseptics.—These terms are convertible, and apply to those materials which impede or arrest fermentative and putrefactive actions. Some are styled germicides, because they destroy bacterial life and the germs which develop into disease-producing agents. Some of them act in an antagonistic manner to others in the list. I have known authorities using these antagonists at the same time and at the same place, thus counteracting the influence of the one by the other, and letting the cause for their use escape destruction. Another class oxidises the organic matter, burning it up, and altering its chemical constitution, by which means it becomes harmless.

Permanganate of Potass (Condy's fluid) is a representative of this class: it rapidly alters fluids which are in an incipient stage of decomposition if it be used in quantity sufficient for the purpose, but it has no action upon living germs, it is not a germicide. Others coagulate albumen, and delay putrefaction, and give time for the use of more direct means for safety. They are dangerous if their effect is not understood, *i.e.*, weak solutions of carbolic acid. These solutions act as impeders of putrefaction; they are preservatives, and will preserve disease germs as well as animal food, and when used in an ignorant manner will only postpone until to-morrow that which had better be faced at once. I have seen carbolic acid used in quantity at a sewage outfall. The sewage was rendered odourless by it. It was discharged into a water-course. I stirred up the carbolic acid from the mud in the bottom of the water-course, but four miles away from the outfall the repressing influence of the carbolic acid was lost; putrefactive change resumed its sway, and nuisance was established. I believe carbolic acid will preserve disease germs from decomposition when used in small quantities, as when smeared over fences which have been contaminated by animal excreta or saliva from infected cattle. The saliva has soaked behind a layer of bark, the carbolic acid has preserved it from decomposition; the bark has been removed, and with it the coating of carbolic acid: the disease has again appeared when cattle have returned to the place. The only safe remedy in such cases is to burn the infected material; wood which has been impregnated with disease germs cannot be purified, but should be destroyed by fire. But carbolic acid is of the greatest use when the air is well charged with it, and kept so in a dwelling-house in which infectious disease exists. The air should be kept thoroughly impregnated with the vapour. It arrests the growth and fructification of most kinds of fungi, it restrains putrefactive changes, and probably prevents the fructification of algals, the multiplication of bacteria, and so limits the spread of infective disease.

Creosote has been employed for purifying the air, but it is more medicinal than disinfectant, and should only be used by the advice of the medical attendant. The same remark applies to the use of *Iodine*, *Iodoform*, and *Bromine*.

Sulphurous Acid obtained by burning sulphur upon charcoal, or by burning sulphide of carbon in an ordinary spirit lamp, is the best of all disinfectants for aerial use. Any room which requires disinfection should have all things likely to be damaged by the acid fumes removed from it. The windows should be securely closed, all crevices covered by brown paper pasted over them. A slab of stone should be then placed in the middle of the room, and upon it an iron basket containing live coals, and upon the coals a quantity of sulphur sufficient for the size of the room. Half a pound of sulphur will be sufficient for a room containing 4,000 cubic feet of air. Care must be taken not to set the floor on fire. An eight-ounce spirit lamp with sulphide of carbon (SC), placed on a slip of iron over a tub of water, is an elegant and simple way of effecting the same object. The SC is highly inflammable and must be handled with care, but it consumes entirely and is more to be depended on than the sulphur. The room should be closed up for twenty-four hours, and then thoroughly ventilated.

Chlorine Gas is sometimes used. Common salt should be mixed with binoxide of manganese in equal weights. The containing vessel should be of glass or glazed earthenware. It should be placed in a large tub of boiling water in the middle of the room to be disinfected. Two parts of sulphuric acid and two of water should then be poured upon the mixture, and the room closed up. The chlorine will continue to be evolved until the hot water has cooled down. This is the safest way of proceeding when there might be great damage from fire, but chlorine when continually breathed acts as an irritant to healthy people, and must not be continuously used in occupied rooms.

Chloride of Lime is much employed; it is faulty in many ways, but it is cheap, and often used in quantities by local authorities. It is highly offensive, and acts by reason of the chlorine which it evolves. The lime may, however, act somewhat in checking acid putrefactions, such as the butyric acid, which acid is the result of changes which set up the most offensive odours from decomposing sewage.

Chloride of Zinc is a most powerful germicide, but it destroys everything with which it comes in contact, and can only be used when the surroundings are of no consequence, as when masses of cesspool matter

are to be positively destroyed. Weak solutions are useful in earthenware drains and brick sewers, but it should never be used in w.c.'s, for it will destroy all the metallic parts of the closet, if there are any.

Sulphate of Iron, or green copperas, is the safest in the list of disinfectants, and also the most efficient for dealing with quantities of sewage. If sewers are well flushed down with a solution of sulphate of iron, using about one pound to two gallons of water, and taking care to mix it well with the sewage to be disinfected with no sparing hand, it will do its work safely and effectually, but at least a quarter of a pound should be used to disinfect the stool of a typhoid fever patient, and so in proportion.

Simple Earth.—If the copperas is not at hand, if the chemicals I have mentioned are not forthcoming, and yet there is need of an immediate disinfectant, a shovelful of earth out of the garden will rapidly absorb the noxious matter escaping from the excreta of a cat, or dog, or any other stinking material. It is always at hand in the country, and may be had at once in most town houses. It is effectual in sudden emergencies when nothing else is at hand.

Charcoal and Peat are sometimes used. If powdered loosely and placed in bags, it may be placed under the bedclothes when there are persistent odours as from a gangrenous patient, or in cases of typhus fever. It may be used in hospital wards, a tray loosely filled with small pieces may be placed under a bed, or in cupboards, or on shelves, when there is urgent necessity for action. It rapidly absorbs organic effluvia, and assists to purify the air very satisfactorily.

Quicklime may be used for a similar purpose when Co_2 is in excess. There are many other disinfecting agents such as arsenic, corrosive sublimate, silicate of soda. Some of these must be used in poisonous doses, and are not fit for general application.

Heat as a Disinfectant.—This is the most efficient means by which the germs producing disease may be destroyed. It may be applied directly, as by the cremation process. All contaminated articles which are comparatively valueless should be burned; all wood which has been polluted by excretions or secretions from diseased animals or human beings should be burnt up if possible. I am accustomed to recommend that a yard or barn floor which has been thus polluted, as by the discharges from diseased cattle, should be covered over with breeze, that the breeze should be worked into the soil or surface; the whole should then be scraped up, then mixed with any manure that may have been polluted, then set on fire, and allowed to smoulder until the whole of the contained organic matter is consumed.

Disinfecting chambers have been constructed by Frazer, and also by Washington Lyon, in which hot air is used, in the latter case combined with steam under pressure. In these chambers infected articles are placed; they are exposed to a temperature which should not be less than 250° for some hours for most kind of fabrics, though some will not bear a temperature which is above 220° without injury. The heat must permeate the clothing. The articles must be loosely placed in the chamber, otherwise the heat will not penetrate the texture. The object is to coagulate albuminous matter, and destroy life. Such things as hair mattresses must be pulled to pieces before being put into the chamber, otherwise the heat will not penetrate. Feather beds are disinfected most effectually by steam under pressure. An ordinary drying-closet, when the air can be raised to a heat of 300°, will be effectual in destroying all organic matter which is living if the articles are loose. In those parts of the country in which it is impossible to provide proper chambers a baker's oven may be utilised on an emergency. Undoubtedly heat is the most efficient of all disinfecting agents. Clothes which will wash may be boiled, and thus cleared from all danger, provided the boiling is kept up for several minutes. Let me sum up the best means for disinfecting:—(1) Ventilation, (2) Dry hot air, (3) Hot moist air, (4) Boiling, (5) Cremation, (6) Chemical re-agents. (*a*) Aerial, SO_2 by means of S or SC, or carbolic acid vapour, chlorine; (*b*) By actual contact in the solid or in solution by permanganate of potass, green copperas, chloride of lime, etc.

(To be continued.)

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The New Class-Subject, 'Elementary Science.'

(What to teach, and how to teach it.)

BY RICHARD BALCHIN.

THE following is a continuation of the teacher's notes of the easy lessons in this subject for Standard V. The syllabus was given in the October issue of this magazine. The element chlorine is so important, and the facts connected with its preparation, properties, and compounds so striking and interesting even to young children, that I generally, in the six lessons devoted to the subject, take the opportunity, by entering more than usually into details, to bring prominently before the minds of the scholars those exact methods of scientific investigation by which all knowledge of any value is obtained. It is quite possible to do this and yet not travel beyond the bounds of simple elementary instruction.

LESSON XXXI.—CHLORINE.

Place some common salt in a flask; pour upon it slightly diluted sulphuric acid, 5 volumes of the acid to 1 volume of water. Let two glass tubes, each bent at two right angles, pass from the perforated cork of the flask, and dip into two large test tubes, one of which contains water. Gently heat the mixture in the flask over the spirit lamp. Let two boys come to the table and watch the two receiving tubes—*i.e.*, the test tubes. In the dry tube there is observed a faint white vapour, heavier than the air, for it collects and remains at the bottom of the tube first. The vapour, in fact, displaces the air by lifting it up out of the tube—an instance of what is called 'downward displacement.' Let the boy wet a piece of filter-paper or white blotting paper (bibulous paper) with ammonia solution, and hold the strip just at the mouth of the tube. He will recognise the dense white fumes, and probably conclude he has the chloride of ammonium referred to in the previous lesson; and several boys in the class will no doubt jump to the conclusion that HCl is coming from the salt and sulphuric acid. Check any haste. The other boy will notice that as the bubbles enter the water in the tube they disappear at first, and that the water is rising slightly in the tube—*i.e.*, occupying a larger space, increasing in bulk or

volume, but that after a few moments the bubbles pass up through the water into the air—*i.e.*, we have not only a solution but a 'saturated solution.' Dip in the solution a strip of blue litmus; it turns red. Here, then, we have a gas coming from sulphuric acid and salt which (1) is heavier than air; (2) seems to be hydrochloric acid, for it combines with ammonia and to form chloride of ammonium; (3) it is very soluble in water; (4) the solution of the gas is an acid, for it reddens blue litmus. But does this gas, whatever it is, come from the sulphuric acid or from the salt? Fill three test tubes—one (*a*) with the solution, another (*b*) with a solution of common salt, and a third (*c*) with very dilute sulphuric acid. Add a little nitrate of silver solution to each; (this is made by dissolving silver in nitric acid). In *a* and *b* there is the same dense white precipitate; hence the great probability that the gas is a constituent of the salt.

LESSON XXXII.—CHLORINE.

Make the mixture of salt and sulphuric acid, and recapitulate the four conclusions arrived at in the last lesson. Show further how very soluble the gas obtained is in water. Let a boy get a small test tube full of the gas, place his thumb over the mouth of it, dip the tube down, mouth first, into some water, and then remove his thumb. The gas dissolves in the water, which instantly rises in the tube to take its place. But what *is* this gas? Make another solution of the gas as described in the last lesson. Pour some of it into two flasks containing small (1) iron, (2) zinc clippings. Hydrogen gas is given off. Does this hydrogen come from the water or from the gas in solution? Let us see. Have ready the apparatus described in a previous lesson for decomposing water by heat in an iron tube containing iron turnings. Allow some of the dry gas—from the salt and sulphuric acid—to pass over red-hot iron turnings. Hydrogen gas is given off, and could have come from nothing but our gas, for iron itself is an element. Therefore the gas we have obtained from salt is a compound, *one* of whose constituents is hydrogen; the *other*, or *others*, must have remained combined with the iron turnings. Upon examining these we find that some of them have a few small crystals attached, which can easily be washed off in water. Now, if some nitrate of silver solution be added to the crystal solution, we get the same dense white precipitate which we obtained in the last lesson. This precipitate is a compound consisting of the metal silver and an element called chlorine; it is a chloride of silver. Hence the gas obtained from sulphuric acid and salt is a compound consisting of hydrogen and chlorine, and when dissolved in water is hydrochloric acid. Common salt is chloride of sodium, or the element chlorine in combination with the metal sodium described in a previous lesson.

LESSON XXXIII.—CHLORINE.

Place in a flask some black oxide of manganese (manganese dioxide, or pyrolusite MnO_2); pour upon it hydrochloric acid, and apply a gentle heat. A greenish-yellow gas, chlorine, is given off:—

$$MnO_2 + 4\,HCl = MnCl_2 + 2\,H_2O + Cl_2.$$

The gas may be collected by downward displacement, as described in a previous lesson, for it is $2\frac{1}{2}$ times heavier than ordinary air; it is $35\frac{1}{2}$ times heavier than hydrogen—*i.e.*, its specific gravity is 35·5. Chlorine gas has the property of destroying vegetable colours—that is, it is a bleaching agent. Dip a red rose in water, and let it hang down in a jar of chlorine; it is bleached. On a large scale it would be difficult to use the gas itself for bleaching purposes, so a compound of chlorine is taken—chloride of lime or bleaching powder, $CaOCl_2$. The article to be bleached is first dipped in a solution of $CaOCl_2$ and water, and then into a vat of dilute sulphuric acid. A double action takes place, which, however, is of too complicated a nature to set before boys. It is probably as follows:—

(1) $CaOCl_2 + H_2SO_4 = CaSO_4 + HOCl + HCl.$
(2) $HOCl + HCl = H_2O + Cl_2.$

Hence it would appear that the action of the acid is to displace the lime from the chloride and set free the chlorine, the bleaching agent; and yet it is extremely doubtful whether, after all, it *is* the chlorine which acts *directly* as the bleaching agent. It is highly probable that the so-called bleaching properties of chlorine may be due to the following reaction:—The chlorine unites with the hydrogen of the water, setting free the oxygen, which at once forms oxides with the colouring matter.

LESSON XXXIV.—COMPOUNDS OF CHLORINE.

Refer to two compounds already noticed, *viz.*, common salt or chloride of sodium, and sal-ammoniac or chloride of ammonium. Prepare a jar or two of chlorine as previously described. Soak a piece of white blotting-paper in turpentine. Chlorine has a great affinity for hydrogen, and turpentine is a hydrocarbon, $C_{10}H_{16}$. The paper takes fire spontaneously, hydrochloric acid, HCl, being formed, while the carbon is deposited in the form of dense black smoke. Light a wax taper and dip it into a jar of chlorine; the combustion continues, and we have a good opportunity for recapitulating facts already noticed with respect to combustion. In all previous instances of combustion we have an element, carbon, combining with oxygen, forming carbon dioxide, CO_2. When a taper burns in air or in oxygen, we have seen that the H and C of the taper combine respectively with O, and form H_2O and CO_2. What, then, happens when the taper burns in chlorine, for here we have no oxygen? The explanation is interesting. It is the hydrogen of the taper that burns, that is, enters into combination with the chlorine, forming HCl; while the carbon of the taper, having no oxygen with which to combine, is not consumed, but is, as soon as it is liberated from the hydro-carbon fat-vapour, deposited in the form of black smoke.

LESSON XXXV.—COMPOUNDS OF CHLORINE.

Prepare a jar or two of chlorine as before. Recapitulate facts as to the combustion of a taper in the gas. Drop a little finely-powdered antimony—stibium, Sb—into a jar of chlorine; combustion ensues, and chloride of antimony is formed. Be careful not to breathe near the jar. Let down a small piece of dry phosphorus placed in a deflagrating spoon into a jar of chlorine; the phosphorus will take fire, combining with the chlorine to form terchloride of phosphorus, PCl_3. (*Note.*—If possible, do not let any of the fumes escape, for they are *very* injurious.) If filings of any of the following metals in a state of fine

powder, and previously heated (86°F.), be sprinkled into a jar of chlorine they will take fire and burn with characteristic colours. Antimony, silver, and lead give white colours; zinc and tin, a bluish white; copper, a dull red; iron, a vivid red; arsenic, gold, and tellurium, a green.—(Kemshead.)

LESSON XXXVI.—COMPOUNDS OF CHLORINE.

Recapitulate facts concerning the compounds of chlorine already noticed, such as hydrochloric acid, HCl; common salt, NaCl, etc.

Prepare the following compounds to show how readily Cl combines with the metal-salts, or rather with the metals which form the bases of those salts. Add to dilute HCl a solution of either the acetate of lead (sugar of lead) or the nitrate of lead. We get a white precipitate in either case of chloride of lead, $PbCl_2$, soluble in boiling water.

Add to dilute HCl a solution of nitrate of silver: we get a white precipitate of the chloride of silver, AgCl. Dry some of this precipitate and expose to the air: turns first violet, and then black.

Break up into small fragments (1) white marble, (2) chalk, both of which are carbonate of lime, $CaCO_3$. Place them in separate flasks and pour on to each a little HCl. Collect the escaping gas, which is carbon dioxide, CO_2, and test it. We have remaining in the flask chloride of lime, $CaCl_2$.

Add HCl to carbonate of soda; CO_2 is given off and chloride of sodium, NaCl, is formed.

(To be continued.)

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Lessons in Latin.

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(*Continued from page* 585, *vol.* iii.)

KEY TO EXERCISES.

EXERCISE 41.

A.

1. The battle having been joined (begun), Pyrrhus conquered by the help of the elephants. 2. Quintus Marcius, the consul, having lost by death his only son, a youth of the highest filial affection and great promise (Lat. hope), so restrained his grief that forthwith from the funeral pyre he sought the Senate House, and there earnestly applied himself to the business of his office. 3. Lucius Mummius who, having taken Corinth, adorned the whole of Italy with pictures and statues, out of so much booty, appropriated nothing to his own use; so that, when he was dead (lit. he being dead) there was nothing out of which his daughter might receive a dowry. 4. Wherefore the senate decreed to her a dowry out of the Public Treasury. 5. A state having been founded, which he called Rome, after his own name, he received a multitude of the neighbours into the state. 6. And when a tempest suddenly having arisen he did not appear, he was believed to have gone to the gods, and to have been deified.

B.

1. Nam, quum filius ejus—Collatini uxorem injuria affecisset, in omnium conspectu se occidit. 2. Quumque imperavisset annos viginti quinque, cum uxore et liberis suis fugit. 3. Quum Romanos sæpe vicisset, usque ad urbem accessit. 4. Tum se Marcus Vallerius tribunus militum obtulit et, quum processisset armatus, corvus ei in galea consedit. 5. Ille, occasione repertâ, felicissime dimicavit et Samnitas delevit. 6. Postea Pyrrhus, junctis sibi Samnitibus, Romam perrexit, atque omnia ferro ignique vastavit. 7. Unum ex legatis Romanis (or -orum) Fabricium sic admiratus est ut, quum eum pauperem esse cognovisset, quarta parte regni promissa sollicitaverit, ut ad se transiret.

EXERCISE 42.

A.

1. When we entered the bedroom of Cato we caught him sitting and holding a book within his hands. 2. Caesar was the first of the Romans, who, a bridge having been made, having attacked the Germans living across the Rhine, destroyed them with great slaughters. 3. But (Eng. now) a cave restrains Scylla (within its) dark hiding places, thrusting forth her mouth and drawing the ships on to the rocks.

4. At Scyl | lam cae | cis cŏhĭ | bet spē | lūncă | lă | tēbrīs ||

Or' ēx | sērtān | t' ēt nā | vēs ĭn | sāxă trā | - hēntēm ||

5. The Romans, in the midst of the very games, seized the looking-on virgins. 6. Returning home (lit. when she was returning home) she ordered the charioteer to drive the chariot over the body of her father lying in the road. 7. He took and destroyed this city, having been defended (Eng. which had been defended) by the citizens. 8. Boys must be taught that they may be wise. 9. A wolf saw a she-goat standing on a lofty rock.

B.

1. Puellæ sunt docendae ut sapiant. 2. Tullo Hostilio regnante, Romani bellum cum Albanis sustulerunt. 3. Fame coacta, vulpes alta in vinea uvam appetebat, magnis saliens viribus. 4. Quam tangere ut non potuit, discedens ait 'nondum matura est.' 5. Quum decidisset vulpecula in puteum, devenit hircus sitiens in eundem locum. 6. Simul rogavit, esset an dulcis liquor? 7. Illa respondit, descende, amice, optima est aqua. 8. Tum vulpecula evasit puteo, nixa celsis cornibus, hircumquè clauso liquit hærentem vado. 9. Simonides circumire cœpit urbes Asiae nobiles, mercede accepta, laudem victorum canens. 10. Tum venatores dolentes canem objurgabant.

LESSON XLIII.

PERFECT TENSES OF PASSIVE VOICE.

324. All these tenses are compound tenses, and formed by the Perf. Pass. Participle (agreeing in gender, number, and case with the subject) with the tenses of 'esse.'

325. The English words 'is' and 'was' are not signs of the Pres. and Imp. tenses unless followed by a word ending in 'ing.' Thus 'He was forced to fly' would be translated by the Perf., and not the imperfect. Again, 'He is dead' is perfect, not present. Though 'He was come' is the pluperfect tense, 'was' is not a sign of the pluperfect in the Passive voice.

326. In old grammars the Present and Perfect Tenses of 'sum,' with the Past Participle, were given as optional forms of the perfect; but in the Primer only the Present tense is found; but since the other forms are so constantly met with, they will be given here:—

327.

Perfect Indicative.

Singular.

m.	*f.*	*n.*		
Amatus	-ta	-tum	1st.	Sum, or fui
			2nd.	Es, or fuisti
			3rd.	Est, or fuit

Plural.

Amati	-tæ	-ta	1st.	Sumus, or fuimus
			2nd.	Estis, or fuistis
			3rd.	Sunt, or fuerunt

Eng.—I, etc., have been loved.

Pluperfect Indicative.

Singular.

Monitus	-ta	-tum	1st.	Eram, or fueram
			2nd.	Eras, or fueras
			3rd.	Erat, or fuerat

Plural.

Moniti	-tæ	-ta	1st.	Eramus, or fueramus
			2nd.	Eratis, or fueratis
			3rd.	Erant, or fuerant

Eng.—I, etc., had been advised.

Future Perfect Indicative.

Singular.

Rectus	-ta	-tum	1st.	Ero, or fuero
			2nd.	Eris, or fueris
			3rd.	Erit, or fuerit

Plural.

Recti	-tæ	-ta	1st.	Erimus, or fuerimus
			2nd.	Eritis, or fueritis
			3rd.	Erunt, or fuerint

Eng.—I, etc., shall have been ruled.

Perfect Subjunctive.

Singular.

Auditus	-ta	-tum	1st.	Sim, or fuerim
			2nd.	Sis, or fueris
			3rd.	Sit, or fuerit

Plural.

Auditi	-tæ	-ta	1st	Simus, or fuerimus
			2nd.	Sitis, or fueritis
			3rd.	Sint, or fuerint

Eng.—I, etc, may have been heard.

Pluperfect Subjunctive.

Singular.

Factus	-ta	-tum	1st.	Essem, or fuissem
			2nd.	Esses, or fuisses
			3rd.	Esset, or fuisset

Plural.

Facti	-tæ	-ta	1st.	Essemus, or fuissemus
			2nd.	Essetis, or fuissetis
			3rd.	Essent, or fuissent

Eng.—I, etc., might have been made.

Perfect Infinitive.

Singular.

Latum	-tam	-tum	Esse, or fuisse

Plural.

Latos	-tas	-ta	Esse, or fuisse

Eng.—To have been carried.

The accusative of the participles are given as the subject of an infinitive mood is put into the accusative case; but 'latus esse' will be found whenever the person or thing carried is the subject of the finite verb of the clause, as 'Dicitur latus esse trans flumen,' 'He is said to have been carried across the stream.'

328. VOCABULARY.

English.	*Latin.*		*English Deriv.*
To come between — to intervene	Intervĕnire	P. R. Intervĕn.	Intervention
To send	Mittĕre	P. R. Mis.	3rd R. Miss.
	m. *f.* *n.*		
Neighbouring —near	Vicinus -na -num	R. Vicin.	Vicinity
Meeting	Obvius -ia -ium	R. Obvi.	Obvious
Alban	Albānus -na -num	R. Alban.	
To throw between — (of time, pass)	Interjĭcĕre	P. R. Interjēci	3rd R. Interject.
To declare (war)	Indĭcĕre	P. R. Indix.	Indict
To receive under protection	In fidem accipĕre	P. P. in f. accĕp.	3rd R. In f. accept.
Thence	Inde, an adverb		
To lead back	Abdūcĕre	P. R. Abdux.	3rd R. Abduction.
Prince—Chief	Princeps	Principis	Principality
Spoils	Spolia, pl. no sing.	O decl.	
Before—in front of	Præ, prep. gov. ab.		
To carry	Gĕrĕre	P. R. Gess.	3rd R. Gest.
To espouse	Dēspondĕre	P. R. Despond.	3rd R. Despons.
Before	Ante, prep. gov. acc.		
Gate	Porta	G. Portae.	Porter
To recognise	Cognoscĕre	P. R. Cognov.	3rd R. Cognit.
Shoulder	Humĕrus	G. Humĕri.	
A cloak (military)	Pālūdāmentum	G. Paludamenti.	
Spouse — betrothed	Sponsus	G. Sponsi, s	
Hair	Crīnis	G. Crinis, m.g.	
Tearfully	Flebiliter, an adv.		
To call	Appellāre	R. Appell.	Appellation
To move	Mŏvĕre	P. R. Mōv.	3rd R. Mōt.
Judgment	Jūdĭcium	G. Judicii.	
To call out	Prōclāmāre	R. Proclam.	Proclamation
Right (human law)	Jus	G. Jūris.	
To kill (cut to pieces)	Caedere	P. R. Cĕcid.	3rd R. Caes.
To make (thoroughly)	Conficĕre	P. R. Confēc.	3rd R. Confect.
To judge — to consider	Jūdĭcare	R. Judic.	Judicature
Already—by this time	Jam, an adverb		
To send forward	Præmittĕre	P. R. Præmīs.	3rd R. Præmiss.
To lead over	Trādūcĕre	P. R. Tradux.	3rd R. Traduct.
Commander	Imperātor	G. Imperatoris.	
To throw	Conjĭcĕre	P. R. Conjēc.	3rd R. Conject.
Chain	Cātēna	G Catenae	
To subdue	Sūbigĕre	P. R. Subēg.	3rd R. Subact.
Unless	Nisi, a conj.		
To ascend (embark)	Adscendĕre	P. R. Adscend.	3rd R. Adscens.
Carthaginian	Carthāgĭniensis	G. Carthaginiensis	
After that	Postquam, adv. and conj.		
To remove	Rĕmŏvĕre	P. R. Remōv.	3rd R. Remōt.
To quench (hunger)	Exĭmĕre	P. R. Exēm.	3rd R. Exempt.
To ask (in conversation)—To recall	Rĕquīrĕre	P. R. Requisīv.	3rd R. Requisīt.
Long	Longe, an adverb		
Companion	Sŏcius	G. Socii	Social
Conversation —talk	Sermo	G. Sermōnis	
To break	Frangĕre	P. R. Frēg.	3rd R. Fract.
Disorder	Perturbatio	G. Perturbationis	
To make or do	Făcĕre	P. R. Fēc.	3rd R. Fact.
Fight	Pugna	G. Pugnae	Pugnacious
Feast	Epŭlae	G. Epularum.	

329. EXERCISE 43.

A.

L. stands for Livy. *E.* for Eutropius.

1. Interjecto anno (17) contra (17) Pyrrhum Fabricius est missus. E. 2. Tum, (20) quum (13) vicina

castra (37) ipse et rex (8) haberent (7) (translate 'quum haberent,' 'having') medicus (29) Pyrrhi ad eum (37) nocte (29) venit (19), promittens (29) se (35) (insert 'that') veneno (33) Pyrrhum occisurum (30) esse si (15) sibi (35) aliquid (E. something) daret (12) E. 3. Salentinis in Apulia bellum (16) indictum est captique (26) sunt cum (20) civitate (14) simul (42) Brundusini. E. 4. Quinquaginta (E. fifty) civitates (14) in fidem acceptæ sunt. E. 5. Exercitus (19) inde domos (1) abducti (sunt, understood) L. 6. Princeps Horatius ibat (E., 'was going' irr. imp. of 'ire') spolia prae se (35) gerens; cui (27) soror (8) virgo (14) quæ (27) desponsa uni (31) ex (26) Curiatiis fuerat, obvia ante portam Capenam fuit (38) L. 7. Cognito que super (42) humeros fratris (14) paludamento sponsi, quod (27) ipsa (40) confecerat solvit (33) crines et flebiliter nomine (20) sponsum mortuum (Eng., 'dead') appellat. L. 8. Moti homines (5) sunt in eo (37) judicio maxime (Eng., 'very much') P. Horatio (the 'a' is omitted here before P. Horatio, as the fact is referred to rather than the individual) patre (14) proclamante se (35) filiam (7) jure cæsam (esse) judicare. L.

B.

1. Between (42) these (37) (things) (Eng., meanwhile) the Alban cavalry (39) had been already sent forward, who (27) should (Eng., 'to') lead over the multitude (41) (to) Rome. 2. Five hundred (Lat., quingenti) (men) with (20) their (20) commander Regulus were taken (perf. tense); Regulus himself (40) was thrown into chains. 3. And then (20) Africa would have been subdued unless a famine (Eng., hunger, 40) had been suffered (Eng., experienced; plup. sub. pass. of 'habeo'). 4. Lutatius sick (35) ascended (Eng., went on board) the ship (9), for (40) he had been wounded (17) in the previous (use proper case of superior G. -oris) fight (10). 5. The Romans (20) who (27) were held (18, imp. tense) captive (29) were sent back (29) by the Carthaginians. 6. After that hunger (40) was quenched by the feasts, and (use 'que') the tables (8) were removed, they recall in their talk their long-lost (20) companions. Together (Lat., una) with (20) these (37) ambassadors (41) Commius came (19) to Atrebæ (Lat., Atrebas), whom (27) I had (Eng., have) stated (Lat., shown, 13) above (42) to have been sent to Britain (16). 8. Many (20) ships (9) having been broken, a great (20) disorder in (Lat., 'of,' use gen.) the whole (31) army (19) was made (Eng, arose).

LESSON XLIV.

CARDINAL NUMERALS.

330. The first three numbers, 'unus'—'one,' 'duo'—'two' and 'tres'—'three,' are the only cardinal numerals less than 200 which are declined.

331. 'Unus' has been already declined in Lesson XXXI., being perfectly regular, except in the gen. and dat., which are 'unius' and 'uni' respectively for all genders.

332. 'Duo' is thus declined, and it no doubt shows how all 'o' and 'a' adjectives were originally declined in the plural (except perhaps the neut. of the nom. and acc.)

	m.	f.	n.
N. V.	duo	duæ	duo
Ac.	duos	duas	duo
G.	duorum	duarum	duorum
D. Ab.	duobus	duabus	duobus.

333. Three is thus declined:—

		m. f.	n.
N. V.	N. V. A.	tres	tria
	G.	trium	trium
	D. Ab.	tribus	tribus

334. The following numbers are indeclinable:—

4 quătuor	14 quatuordĕcim	30 triginta
5 quinque	15 quindĕcim	40 quadraginta
6 sex	16 sēdecim	50 quinquaginta
7 septem	17 septemdĕcim	60 sexāginta
8 octo	18 duodēvīginti	70 septuāginta
9 nŏvem	19 undevīginti	80 octoginta
10 dĕcem	20 vīginti	90 nonaginta
11 undĕcim	21 unus et vīginti	99 undēcentum
12 duodĕcim	28 duodētrīginta	100 centum
13 trēdĕcim	29 undetrīginta	101 centum et unus.

335. The following numbers, except mille, are declined like 'o' and 'a' adjectives:—

200 dŭcenti -æ -a	1000 mille
300 trĕcenti	2000 duo millia
400 quadringenti	5000 quinque millia
500 quingenti	10,000 decem millia
600 sexcenti	50,000 quinquāgīnta millia
700 septingenti	100,000 centum millia
800 octingenti	500,000 quingenta millia
900 nongenti	1,000,000 decies centum millia.

336. Mille in the singular is indeclinable. In the plural it is thus declined:—

N. V. A.	millia
G.	millium
D. Ab.	millibus.

Note.—Time how long is expressed by the acc., but the time within which an event happened is expressed by abl. without prep.

337. The ordinals and distributives will be discussed in a future lesson.

338. VOCABULARY 44.

English.	*Latin.*		*Derivative.*
Lightning	fulmen	fulmĭnis	fulminate
To strike	īcĕre	īcī 3rd R.	ict
To enrol	conscrībĕre	conscrips	conscription
To be born	nasci (short e conj.)	3rd R.	nat.
Sovereignty	dŏmĭnātio	G. dominationis	
To exercise	exercēre	exercu 3rd R.	exercit
Fable	fābŭla	G. fabulæ	Fabulous
Robber	prædo	G. prædonis	
Stadium = furlong	stadium	G. stadii	
Greek	Græcus-ca-cum		
To make (equal)	efficĕre	R. effēc 3rd R.	effect
Pace (two Eng. steps)	passus	G. passūs	
Foot	pes	G. pĕdis	pedestrian
Cohort	cŏhors	G. cohortis	
Maniple	mănĭpŭlus		
Century	centuria	(Eng. company)	
Lake	lăcus	G. lacūs	
Age—Period	ætas	G. ætātis	
Infancy	infantia	G. infantiæ	
To extend / To lie open	pătĕre	P. R. patu 3rd R.	none
Youth (abstract)	adolescentia	G. adolescentiæ	
Nearly	prŏpe (an adverb)		
To equal	æquāre		
Drachma	drachma	G. drachmæ	
Attic	Attĭcus-ca-cum		
Talent	tālentum	G. talenti	
To rule	impĕrāre		emperor
Nearly, almost	fĕrĕ (an adverb)		

339. EXERCISE 44.

A.

1. Tullus quum triginta duos annos (17) regnavisset (4), fulmine ictus cum (20) domo (1) suâ (20) arsit (37) E. (Eutropius has 'duobus annis' and abl. again in sentence 2.) 2. Ita (17) Romæ regnatum est (Eng., royal power was held) per (3) septem reges (8), annos (17) ducentos quadraginta tres (E). 3. Hamilcar, dux (39) Carthaginiensium (43), filium (7) Hannibalem annorum (17) novem secum [=cum (20) se (35)] in (4) Hispaniam (19) duxit (9). 4. Sex millium et ducentorum hominum (5) primus (20) Caius Marius legionem (19) conscripsit, quum antea (19) quattuor millium fuisset (38). 5. Dionysius quinque et viginti annos (17) natus Syracusarum (Syracuse, a plural word) dominationem obtinuit (20) eamque (37) duodequadraginta annos (17) exercuit. 6. Annis (17) fere quingentis post (17) Romam conditam (41) Livius Andronicus primam (20) fabulam docuit (3). 7. Cæsar a prædonibus captus (26) manebat (23) apud (29) eos (37) quadraginta dies (8) cum (20) medico (29) uno et duobus servis (7). 8. Sub (16) eo (37) Roma, habuit (7) capitum (11) octoginta tria millia civium (8) Romanorum cum (20) his (37), qui (27) in agris (5) erant (38).

B.

1. The stadium of the Greeks made (Eng. equalled) one hundred and twenty-four (of) our (39) paces, that (hoc) is (38) six hundred and twenty-five feet. 2. In a Roman (20) legion (19) there were (38) ten cohorts, thirty maniples, sixty centuries. 3. Cæsar carried (perducĕre) a wall (9) and (que) a ditch (18) from (31) Lake Lemannus to (10) Mount (20) Jura. ten thousand (acc.) paces (gen.). 4. The first (20) age of the Roman (20) people (16) was (38) under (16) kings (8), through (for) almost (3) two hundred and fifty years (17), this (37) was (38) its (37) infancy. 5. The other (31) (Eng. second) period again (20) extends for two hundred and fifty years (17) (abl.), in which (27) it subdued (43) Italy (20); let us call (dicere) this (37) its (37) youth. 6. The denarii (Lat. same word) of the Romans (20) nearly equalled (imp. tense) the Attic drachmæ, of which (27) six thousand made one talent. 7. I have received (28) six hundred (of) your (20) letters (7). 8. And (que) having ruled twenty-eight (Lat. two from thirty) years (17), he fled (27) with (20) his (20) wife (9) and his (20) children (11).

(*To be continued.*)

Article 106 (*b*).

Merit Grant in Infant Schools.

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Section II.—Phenomena of Nature

LESSON—WINTER.

CAN you tell me how many parts of the year we have talked about? What names did we give to them? Spring, summer, and autumn. And what was the one name for all of them? The seasons. How many seasons are there? Then, you see, there is still one you have to tell me about. Which is it? Yes, it is the winter. When does the winter begin? What kind of weather do we have then? What kind of weather did you say we had in the autumn? At first warm, and then it gradually gets colder. And what can you tell me about the days? They get shorter and shorter. Yes, and by the time the winter comes we have very short days. When we get up in the morning we are obliged to have a light; and in the evening it is dark long before you go to bed, although you go to bed earlier than you did in the summer-time. Well, John, what have you to say? It is dark before we leave school, and teacher always has the gas alight. Yes, that is quite right. Does she light the gas in the summer-time? Do you remember hearing about a day we called the longest day? When do we have the longest day? In the summer. Do you remember on what day? Yes, on the 21st of June. Well, we have one day we call the shortest day, and it comes on the 21st of December. In what season is the shortest day? You told me just now that we had very cold weather in winter. Can you tell me what the cold often does? It freezes the water. What do you mean by this? The water turns into ice. What do men and boys do then? They go on the ice and have a great deal of fun. Yes; we say they skate and slide on the ice. The teacher should show the children a pair of skates and describe how they are used. Do you like to slide on the ice? You must be very careful not to fall on the ice, and you should not go on it before you are told. Sometimes the ice is not very thick, and then it is not strong enough to bear you. Do you know what happens if the ice is not strong enough? Yes; sometimes it cracks. What is under the ice? Water. Does the ice sink when it cracks? Oh no, it floats on the water. What happens, then, when it cracks with people on it? The people fall into the water. Yes, and this is very dangerous. Sometimes they get under the unbroken part of the ice, and then they cannot be got out. What happens to them then? They are drowned. Even if they are got out they are often very ill, for the water makes them very cold. So I hope before you go on the ice you will wait and see if it is strong enough. Very often you will see men watching the ice, and they will tell you if it is safe. Can you tell me any other places where the boys make slides? Yes, in the garden and in the streets. Yes, I have often seen the boys having fine fun on these slides. But the slides in the street are very dangerous, and ought not to be made there. Can you tell me why? Yes; old people walking along slip and fall on them.

What can you tell me about the roads in frosty weather? They are often very slippery. How do the horses get along? Not very well. Often the drivers let them walk, and sometimes you see men leading the horses. When do they do this? When the roads are very, very slippery. What else do men do to help the horses? They throw sand in the road. Yes; but what do they do to the horses? Well, if you were to look at the horses' shoes in warm and cold weather you would see a difference. See, here is a shoe worn in the summer, and here is one used in the frosty weather. The teacher should lead the children to see the difference, and explain what is done to the shoes. When the weather is so very cold and we have no water in the houses because the water is frozen in the pipes, what do you have to do? Fetch the water from the street. Yes, you will see the man who turns the water on putting pipes into the holes in the road where the water-plugs are. You have to get all your water from here. This is a great trouble to your mothers, and therefore you must be very careful and not waste the water. What do we call the man who turns on the water? The turncock.

What else do we see in the winter? We often see the ground covered with snow. What do boys do then? They play at snowballs, and also make snow men. Yes; I once saw a number of boys with a ball of snow, which they kept rolling over and over, until it got too heavy for them to move. It was very large then, and they had great fun climbing and jumping on it. All the games you play at in the winter must be those that make you run

about. It does not do to stand still. Can you tell me why? Yes, we catch cold and get ill if we do not run about when the weather is cold. Is the weather always as cold as this? No; sometimes we do not have any snow or ice, but a great deal of rain. Yes; then boys and girls have to stay indoors; and they soon get tired of doing so, and wish the summer would come with its bright, sunny days.

Now there is one part of the winter that we all like very much. Do you know which part I mean? Yes, Christmas-time. Why do you like Christmas? Because we have Christmas pudding and all sorts of nice things; then we also have such a deal of fun, and we go out to parties. What do you like to have at these Christmas parties? We like to have nice Christmas-trees. What are they? Why do you like them so much? Yes, they look very pretty with the toys on them and the many candles alight. Then it is great fun to play for the toys on the trees. Sometimes each child gets two or three toys. Then your fathers and mothers are also very pleased and happy. When Christmas Day has gone, there comes another day soon after that we all think a great deal about. Do you know which day I mean? Yes, New Year's Day. Why do we say it is New Year's Day? Well, I will tell you. Which is the first month of the year? January. Yes; and this comes soon after Christmas. Then the first day of January is the first day of the New Year. Now tell me when New Year's Day comes. Why do we call it New Year's Day? What do we say to people on this day? We wish them a happy new year. Why do we do this? Because we want them to be happy all the coming year. Soon after this we begin to find the days get a little longer, and we think of the next season. Can you tell me the name of the one that follows winter? Yes, it is the spring. Now tell me how many seasons there are. Which is the hottest and which is the coldest? When is the longest day? When the shortest?

LESSON—COTTON.

I. *Qualities and Uses.*—Tell me some of the different things we use for clothing. Coats, dresses, etc. What do little girls wear over their dresses? Pinafores. Yes, and they also wear a great many things under their dresses. Tell me the names of some of these things. Can you tell me of what boys' coats and trousers are made? They are made of cloth. And of what is cloth made? It is made of wool. Now can you tell me of what pinafores are made? And the underclothes? Well, we will have a chat about cotton to-day. Look at this piece of calico or cotton. What can you tell me about it? It is white. Yes, and this piece of cotton? And this piece? So you see the cotton stuff is not always the same colour. It is dyed these different colours. Now feel this piece. What can you say about it? It is soft and smooth. Take this piece of cotton in one hand and this cloth in the other, and see what you can find out. The cotton is lighter than the cloth. Yes, the piece of cotton is much lighter than the cloth. Which do you think keeps us the warmer? The cloth. Then when is the best time to wear clothes made of cloth? And when would you sooner wear cotton dresses? Yes, if you pay attention you will notice that little girls wear cotton dresses in the summer and little boys wear cotton suits. We often call these suits washing suits, can you tell me why? Because they are thin and easily washed. I daresay you remember that in the summer you have several of these suits, but in the winter you wear only one suit. Of what is it generally made? Of thick cloth. Yes, and this is not so easily washed.

Can you tell me anything else besides clothes that are made of cotton? What do your mothers put at the windows? Curtains and blinds. Well, the blinds and curtains are often made of cotton. Then some of the bed-clothes are made of cotton. Can you tell me some? Yes, sheets, quilts, pillows, and blankets. Willie says the blankets are made of cotton. See, here is a piece of blanket. Do the little threads look like cotton? Of what do we say the blankets are made? The blankets are made of wool. Yes, they would not be warm enough made of cotton. Another little boy said the pillows. Which part of the pillows did he mean? Yes, he meant the outside, or, as we say, the pillow-cases. Then we also have the reels of cotton which are used for sewing.

II. *From whence obtained.*—Now you have found out how useful cotton is perhaps you would like to know where we get it. Well, Annie says we get it from the cotton-tree. Do you think it grows on the tree like this? Have any of you seen a cotton-tree? Harry says he has seen a picture of one. Yes, you cannot see the cotton-tree growing in this country. It grows in very hot countries, a very long way from here. See, here is a picture of the cotton-plant. Look and I will try and tell you about it. One kind grows very large and is called a cotton-tree, but the kind you are looking at only grows about two or three feet. This height should be shown to the children. A little boy about the size would be a good example. What colour would you say (looking at the picture) the leaves are? A dark green colour. And the flowers? A light yellow. Yes, we say a pale yellow. But I can see another colour. Yes, some purple in the middle. The teacher should then direct the attention of the children to the seed-pods, and then show specimen of seed-pods covered with the soft, downy threads. The children should also have pointed out to them that the little seeds are mixed with the cotton.

When the pods are ripe a great number of people are employed to pick them off, and then before the cotton is packed all the little seeds are picked out. The soft cotton is then packed into large bundles. These bundles are called bales. The bales are then sent to this country. How do you think they are brought to this country? Were did we say the cotton-plant grew? In hot countries a long way off. Well, then how is the cotton brought here? In ships. Yes, the ships come across the sea with it.

Now when we get this cotton is it ready for use? See, here is some in the same state as it was sent. Does it look like the cotton you generally see? Well, then, first of all it must be cleaned, and after that we say it has to be spun into threads. See, here is some. You see I can easily break it. These threads are afterwards woven together and at last we have a piece like this and call it calico. Can you easily break this? You can tear it if you pull it quickly. Now look at these pieces of calico and you will see that they are made up of threads crossing each other. When you are older I will tell you more about the way the cotton is spun and woven into calico and stuff for dresses and other things.

III. *Summary*—This should be written on the board as the lesson proceeds and afterwards written by the children on their slates. The elder children might write it from memory.

Cotton is made into calico, stuffs for dresses, and sewing cotton.

Cotton is made into curtains, blinds, sheets, and quilts.

The cotton-plant grows in hot countries.

Cotton is the soft substance round the seeds.

Many things are done to the cotton before it is ready for use.

Section IV.—Common Employments.

LESSON—THE FISHERMAN.

WHAT do you sometimes have for dinner instead of meat? Fish. Tell me the names of some of the different kinds of fish? Herrings, cod, haddocks, plaice, salmon. Where does your mother get the fish? From the fishmonger and sometimes from the fish-market. But where do these people get the fish? From the man who catches it. What do we call the men who catch fish? They are called fishermen. Where do the fishermen find the fish? Then where would you expect to see fishermen? Who has been to the seaside? Well, Mary, have you seen a fisherman? How did you know he was one? By his dress. How was he dressed? He had on a very thick,

warm coat, like a jersey. And what else did you notice? He had very high, thick boots nearly up to his knees. A very big cap with a piece hanging down his back. Well, here is a picture of one; is it like the dress you saw? Why does the fisherman need all these thick things? Because he has to go on the sea. Well, let us talk about the work he has to do. You told me he has to catch fish —where does he do this? On the sea. How does he get on the sea? In a boat. Yes, these boats are called fishing boats. Can you tell me anything about them? They often have one or two sails. Of what use are the sails? They help the boat along. What does the fisherman take in his boat? He takes nets and long lines. What are on the long lines? Hooks. What does the fisherman put on the hooks? Well, Harry? I saw a man putting worms on. And you, John? The fisherman I saw put small fishes and mussels on the hooks. We call all these different things by one name. What is it? We say they are bait. What is the use of the bait? It helps to catch the fish. If you put the line in the water without bait could you catch the fish? No, the fish would not come to the hooks. The bait is put over the hooks, and the fish only thinks it is going to eat some food and swallows the hook. Another day I will tell you how the fisherman uses the nets. Can you tell me when the fisherman goes out to fish? Yes, in the evening. And how long does he stay out? Sometimes he stays out more than one night. Then, you see, he has to take food with him. When he comes back he sometimes has a boat full of fish. What does he do with it? He sends it to the market. Now, you can tell me why the fisherman needs such a thick coat and warm cap. Yes, sometimes it is very cold indeed, on the water. Why do you think he wants those thick, high boots? Sometimes he has to get out of his boat and pull it on to the land. What do we call the land by the sea? The beach, the shore. Well, if the fisherman had only the same kind of boots that we wear he would get very wet. Sometimes when he is out fishing the water in his boat, and then these thick boots help to keep him dry.

What makes the fisherman look so strong, and gives him such a red face? Have any of you noticed how brown and red your faces get when you go to the seaside? Then you see the fisherman is so much on the sea. What kind of hands has he? Very rough, strong ones. What makes them like this? Yes, he has to pull the ropes of his boats, and sometimes very heavy loads of fish. Does he like doing this? Yes, because he knows he will have more fish to sell. I suppose you think it is very nice to be a fisherman, and go out on the water in a boat. But you must remember that the fisherman has to go out at night when it is very cold, and he must go even when it rains. Sometimes the wind blows very hard and the poor fishermen are drowned. Then he sometimess works very hard all night and does not catch any fish. So, you see, the fisherman's life is a very hard and dangerous one.

The teacher, by way of recapitulation, should get the children to describe the fisherman's dress, his work, the kind of life he leads, and what kind of men are required for this life.

(To be continued.)

Chemistry of the Non-Metallics.

BY EDWARD AVELING, D.Sc. LONDON.

[This series of articles, whilst dealing with the subjects required by the University of London for the Matriculation Examination and with those required at the Elementary Stage of the Inorganic Chemistry (Branch X.) Science and Art Department, is intended as a practical guide to the philosophical and systematic study of the non-metallics.]

CHAPTER V.—HYDROGEN (*continued*).

EXERCISES ON HEAT-UNITS AND THE POTENTIAL HEAT OF WATER AND OF STEAM (*solved*).

(48) How many grams of water at 100° would be needed for the complete conversion of one kilogram of ice at 0° into water at 0°?

1 gram of ice at 0° requires 80 thermal units to melt it.
1000 grams ,, require 80×1000 ,, them.
100 thermal units are given out by 1 gram cooling from 100° to 0°.
1 ,, unit is ,, $\frac{1}{100}$,, ,,
80,000 ,, units are ,, $\frac{1}{100} \times 80{,}000$
$= 800$ grams cooling from 100° to 0°.

(49) 2 grams of water at 20° are mixed with ice. How much ice is melted?

1 gram of water at 20° gives out 20 thermal units in passing from 20° to 0°.
2 grams ,, ,, give ,, 40 ,, ,, ,,
1 gram of ice requires 80 thermal units to melt.
$\therefore \frac{1}{2}$ gram of ice will be melted.

(50.) $\frac{1}{2}$ gram of ice is to be melted, and the resulting water raised to 20°. What mass of water at 25° would effect this?

1 gram of ice requires 80 thermal units to melt, and 20 thermal units to raise the resulting water to 20°.
$\frac{1}{2}$ gram of ice requires 40 thermal units to melt, and 10 thermal units to raise the resulting water to 30° = 50 thermal units required.
Water, in passing from 25° to 20°, gives out 5 thermal units per gram.
50 thermal units are required; $\therefore \frac{50}{5} = 10$ grams of water must be used.

(51.) $10\frac{1}{2}$ grams of water at boiling-point are mixed with a certain mass of ice, and the resulting temperature is that at which the maximum density of water is attained. What was the mass of the ice?

The maximum density of water is attained at (say) 4°. $10\frac{1}{2}$ grams of water at 100° give out $96 \times 10\frac{1}{2}$, or 1008 thermal units, in passing to 4°. 1 gram of ice requires 80 thermal units to melt and 4 thermal units to raise it to 4°; 1 gram, therefore, will require 84 thermal units.
Let x be the number of grams of ice.
Then $x = \frac{1008}{84} = \frac{84}{7} = 12$ grams.

(52.) $27\frac{1}{2}$ grams of water at 15° are mixed with 25 centigrams of ice. Find the resulting temperature.

1 gram of water at 15° will give out 15 thermal units in passing from 15° to 0°.
$27\frac{1}{2}$ grams of water at 15° will give out $15 \times 27\frac{1}{2}$, or $412\frac{1}{2}$ thermal units, in passing from 15° to 0°.
25 centigrams ($= \frac{1}{4}$ gram) of ice require 20 thermal units to melt.
There are $412\frac{1}{2} - 20 = 392\frac{1}{2}$ thermal units to raise temperature of $27\frac{1}{2}$ grams of water at 0°.
Let x be the final temperature.

$$\text{Then } x = \frac{392\frac{1}{2}}{27\frac{1}{2}} = \frac{\frac{785}{2}}{\frac{111}{4}} = \frac{785}{2} \times \frac{4}{111} = \frac{1570}{111} = 14\frac{16}{111}$$

Or let x = number of degrees of final temperature.
Then the $27\frac{1}{2}$ grams of water fall through $(15 - x)$°, and the water resulting from the melting of the ice rises through x degrees.

$$\therefore 27\tfrac{1}{2}(15 - x) = \tfrac{1}{4}(80 + x)$$
$$\frac{55}{2} \times 15 - \frac{55x}{2} = 20 + \frac{x}{4}$$
$$1650 - 110x = 80 + x$$
$$1570 = 111x$$
$$x = 14\tfrac{16}{111}.$$

(53.) 3 grams of solid ice are melted without any rise of temperature by admixture with them of 2 grams of water at 30°. The melting-point and final temperature are 15°. Find the latent heat of the solid.

2 grams of water at 30° give out 30 thermal units in passing from 30° to 15°, *i.e.*, through 15°.
30 thermal units melt 3 grams of the solid; then 10 thermal units melt 1 gram. Now 80 thermal units are required to melt 1 gram of ice, the standard; $\therefore$ latent heat of solid to latent heat of water is as 10 to 80 = 1 : 8 = $\frac{1}{8}$.

EXAMPLES ON HEAT-UNITS AND THE POTENTIAL HEAT OF WATER AND OF STEAM (*for solution*).

(44) How many grams of water at 100° are required to melt 4 grams of ice and raise the resulting water to a temperature of 20°?..... .....5 grams.

(45) 3 grams of ice at 0° are mixed with 42 grams of water at 70°. Find the final temperature of the mixture.....60°.

(46) If 4 grams of a solid in melting absorb the heat given out by 40 grams of water cooling from 28° to 26°, find its latent heat. 20

(47) A solid of latent heat 10, and whose melting-point is 10°, is mixed with water at 20°. If the mass of the solid is 6 grams, what is that of the water, final temperature being 10°?
6 grams.

(48) How many grams of water must be cooled through 70° to melt 7 grams of ice?.....8.

(49) 40 grams of ice and 40 grams of water are mixed at temperatures of 0° and 90° respectively. What is the final temperature? .....5°.

(50) How much ice at 0° must be mixed with a kilogram of water at 95°, that the final temperature may be 15°?
842$\frac{2}{3}$ grams.

Finally, under the head of specialties of water, the different kinds of water must be studied. Taking these in order of purity, they are distilled, rain, spring, river, sea, mineral waters.

i. *Distilled Water.*—This is water wholly free from impurities. It has to be prepared artificially. To distil water on a small scale the apparatus represented in Fig. 17

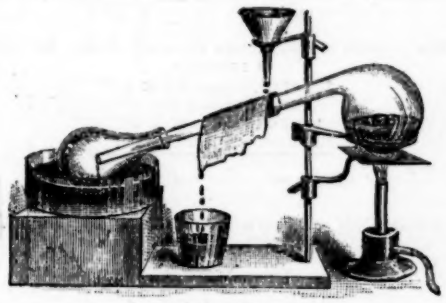


Fig. 17.

is used. The student should make the experiment on water containing some coloured salt, such as copper sulphate, in solution, as the result is then more striking. Place in a retort the solution of copper sulphate. Support the retort on a stand, and place under it a Bunsen's burner. Place between the bulb of the retort and the burner a piece of wire-gauze. Arrange upon one of the rings of the stand above the retort a funnel partly plugged by filter-paper. Place on the neck of the retort filter-paper, and under that an empty beaker. Let water drip through the plug of filter-paper in the funnel on to the filter-paper in the retort. Insert the open end of the retort into a flask that rests in cold water. The heat applied to the retort drives off the water from within as steam, leaving behind the salt that is in solution. The steam passing through the cooled neck condenses again into pure water, and this is caught in the flask. The properties of water given on p. 496 were those of distilled water.

ii. *Rain-water.*—This only contains such gaseous and other impurities as it may have dissolved in falling through the air. 100 cc. of rain-water generally contain about 2$\frac{1}{2}$ cc. of gas.

iii. *Spring-water.*—The spring-water falling to earth flows over and through the soil, dissolving the soluble substances it meets. Like rain-water, it contains gases. 100 cc. of spring-water may contain from 1 to 2 cubic millimetres to 7 to 10 cubic centimetres of gas. The gas most frequently present is carbon dioxide, or 'carbonic acid.'

Of salts in solution those of the metals potassium, sodium, calcium, magnesium, manganese, iron are the most common. Carbonates, sulphates, chlorides of these metals occur most generally. 100 cc. of spring-water contain from ·005 to 3 decigrams of salts in solution.

iv. *River-water.*—The springs flow into the rivers. Therefore, river-water contains gases and salts. But there is always less inorganic matter in a given volume of river than in an equal volume of spring-water. The carbonates especially are thrown down out of solution, as the movement of the water of the river tends to get rid of the carbon dioxide by which these salts are held in solution. But the amount of organic matter contained in river-water is large. From the decay of plants within the stream or on its banks, the secretions and decay of animals living in the water, and from the products of the villages and towns through which the river flows, much organic matter enters its waters. 100 cc. of Thames water may contain 2 decigrams of organic impurities.

v. *Sea-water.*—The rivers flow into the sea ultimately. Sea-water contains gases, much saline and a little organic matter. In 100 cc. of sea-water, on an average, are 3·3976 grams of solid substances. By far the largest quantity of this is common salt, or sodium chloride (NaCl). Then come the chloride and sulphate of magnesium and the sulphate of calcium ($MgCl^2$, $MgSO^4$, $CaSO^4$). As a consequence of the presence of these salts, the specific gravity of sea-water is greater than that of distilled. The average specific gravity is 1·02975 at 0°. That this large quantity of saline matter does not increase by the constant influx of river-water and the constant evaporation of distilled water from the surface of the sea is due to the fact that marine plants and animals remove the salts to form their hard coverings. The sea-water evaporating ascends, and undergoing condensation in the cold upper regions of the air, forms the masses of half-condensed vapour called clouds. These completely condensing as rain, this water circulation of the earth recommences—rain, spring, river, sea, rain again.

vi. *Mineral Waters.*—Spring-water containing an excess of any particular substance is called mineral water. If the excess is carbon dioxide, the water is effervescing, as at Aachen; if of an iron salt, it is chalybeate—from chalybs = steel (Virgil, 'Æneid,' book viii., v. 446)—as the water at Tunbridge Wells; if of sulphur compounds, as at Harrogate, the water is sulphurous; if of common salt or magnesium salts, as Epsom water, which is rich in magnesium sulphate ($MgSO^4$) saline; if of calcium sulphate ($CaSO^4$), selenitic—from *selenite*, one name for calcium sulphate.

(γ.) Steam.—1. *Condition.*—A gas condensing into the liquid form at 100°. Steam is often called a vapour—*i.e.*, a gas near its point of liquefaction.

2. *Effect on Senses.*—Without taste or odour; invisible; the steam seen issuing from a kettle, *e.g.*, is steam condensing into water.

3. *Specific Gravity.*—The symbol of steam is H^2O; therefore its weight-number is $1 \times 2 + 16 = 18$. But steam is a compound gas. By the law given on p. 465 the weight-number of an *element* gas in grams occupies 11·2 litres. The specific gravity of steam is $18 \div 2 = 9$; and generally the specific gravity of any *compound* gas is

one-half its weight-number. On the air-scale the specific gravity of steam is 9 ÷ 14·47.

4. *Solubility.*

5. *Relation to Combustion.*—Not combustible, and not a supporter of combustion.

6. *Specialties.*—Special to steam, as compared with the two other forms of hydrogen oxide, though common to it and other gases, is its behaviour when subjected to heat. The coefficients of expansion—*i.e.*, the amount of expansion of unit volume when temperature is raised from 0° to 1°—are not variable in gases generally. This important fact renders calculations in regard to the volumes of gases, under varying temperatures, very easy. Experimentally the coefficient of expansion of ordinary cases is found to be ·003665, or $\frac{1}{273}$.

Thus 1 litre of gas at 0° becomes $1\frac{1}{273}$ at 1°
" " " $1\frac{2}{273}$ at 2°
" " " $1\frac{10}{273}$ at 10°
" " " $1\frac{273}{273}$, or 2 at 273°
Thus 2 litres " " become $2\frac{1}{273}$ at 1°
" " " $2\frac{2}{273}$ at 2°
" " " $2\frac{10}{273}$ at 10°
" " " $2\frac{2\times 273}{273}$, or 4 at 273°

Calculations are more easily made by remembering that
273 volumes of gas at 0° become 274 volumes at 1°
" " " " 275 " 2°
" " " " 283 " 10°
" " " " 546 " 273°
" " " " 273+x " (0+x)°
and referring everything to 273 at 0°.

EXERCISES ON THE EXPANSION OF GASES (*solved*).

(54) What will be the volume of 455 cubic centimetres at 0° if the temperature is raised to 10°?

273 cc. at 0° become (273+10) at 10°
1 " becomes $\frac{283}{273}$ at 10°
455 " become $\frac{283\times 455}{273}$
$=\frac{283\times 5}{3}=\frac{1415}{3}=471\frac{2}{3}$ cc.

(55) 15 cubic centimetres of a gas are measured off at 27°. What volume will they occupy at 0°?

273 at 0° become (273+27) at 27°;
∴ 300 at 27° become 273 at 0°
1 " becomes $\frac{273}{300}$ at 0°
15 " become $\frac{273}{300}\times 15$
$=\frac{819}{60}=13\frac{9}{60}$ cc.

(56) 4 litres of gas at 17° have their temperature raised 60°. What increase of volume occurs?

(273+17) at 17° have a volume of (273+77) at 77°
1 " has " $\frac{350}{290}$ at 77
4 " have " $\frac{350}{290}\times 4$
$=\frac{35\times 4}{29}=\frac{140}{29}=4\frac{24}{29}$;
∴ Increase of volume $=4\frac{24}{29}-4=\frac{24}{29}$ litre.

(57) 82 cubic centimetres of hydrogen at 55° are cooled down until they occupy a volume of 70 cubic centimetres. What is now the temperature?

Let x=number of degrees of final temperature.
273+55 or 328 at 55° become 273+x at x°
1 " becomes $\frac{273+x}{328}$ at x°
82 " become $\frac{(273+x)\times 82}{328}$
$=\frac{273+x}{4}$
But $\frac{273+x}{4}=70$; ∴ $273+x=280$
$x=280-273$
$=7°$.

(58) 13 litres of gas at normal have their temperature raised to 21° and the pressure increased to 840 millimetres. What is now the volume of the gas?

273 at 0° under pressure of 760 mm. become 294 at 21°
1 " " 1 mm. becomes $\frac{294}{273\times 760}$ at 21°
13 " " 840 mm. become $\frac{294\times 760\times 13}{273\times 840}$
$=\frac{39}{3}=12\frac{3}{3}$ litres.

(59) $17\frac{7}{8}$ cubic centimetres of gas at −13 and under pressure 570 millimetres. What volume will they occupy at normal?

260 at −13° under pressure of 570 mm. become 273 at 0°
1 " " 1 " becomes $\frac{273\times 570}{260}$ at 0°
$17\frac{7}{8}$ " " 760 " become $\frac{273\times 570\times 160}{260\times 760\times 9}$
$=14$ cc.

(60) What change of volume will 5 litres of gas undergo in being raised from −23° through 100°, whilst the original pressure upon them of 800 millimetres is reduced $\frac{1}{8}$?

250 at −23° and under pressure of 800 mm. become 350 at 77°
1 " " 1 " becomes $\frac{350\times 800}{250}$ at 77°
5 " " 700 " become $\frac{350\times 800\times 5}{250\times 700}$
=8. ∴ Change of volume=8−5=3 litres.

(61) 20 cubic centimetres of hydrogen are obtained at normal temperature and pressure. The pressure upon them is now doubled. To what temperature must they be raised that no alteration of volume may occur?

20 under pressure of 760 become 10 under double the pressure or 1520 mm.
273 at 0° become 546 at 273°
1 at 0° becomes $\frac{273}{273}$ or 2 at 273°
10 at 0° become 20 at 273°
∴ Required temperature is 273°.

EXAMPLES ON THE EXPANSION OF GASES.

(*For Solution*).

(51) Find the volume of 8 litres of a gas at 0° and 760 mm. when the temperature is raised to 20°.....$8\frac{160}{273}$ litres.

(52) 1 litre of gas is measured off at 13°C. and under a pressure =78 cm. of mercury. Calculate the volume at normal. .....
$979\frac{13}{20}$ cubic centimetres.

(53) 50 cc. of gas are obtained at 91°C. What will be the change of volume they undergo if the temperature is lowered 45½° and the pressure is doubled?.....$28\frac{1}{4}$ cubic centimetres.

(54) Calculate the change of volume of 60 cc. of gas at normal when the temperature is raised to 312° and the pressure becomes 840 mm. .....$56\frac{1}{3}$ cc.

(55) 4 litres of gas are measured off at 800 mm. (temperature 234°). Find the volume at normal.....$2\frac{88}{247}$ litres.

(56) If a certain quantity of gas at 4° has the pressure upon it quadrupled, to what temperature must it be raised that its volume may not alter?.....835°.

(*To be continued.*)

MOTHER'S PIES.

T. CRAMPTON.

Grazioso.

1st TREBLE.
2nd TREBLE.

1. Of all the pies that the pie-mak-ers make—When the pie-mak-ers make their pies— There
2. Of all the cakes that the cake-bak-ers bake—When the cake-bak-ers bake their cakes— There
3. Of all the songs that the song-sing-ers sing—When the song-sing-ers sing their songs— There

BASS.

KEY G. *Grazioso.*

1st TREBLE.	:m .f	s :- :l	s :f :m	f :s :f	m :r :d	r :m :f	m :- :r	m :- :-	- :- :m
2nd TREBLE.	:d .r	m :- :f	m :r :d	t_1 :t_1 :t_1	d :t_1 :d	l_1 :s_1 :f_1	s_1 :- :t_1	d :- :-	- :- :d
BASS.	:d	d :- :d	d :t_1 :d	s_1 :s_1 :s_1	d :r :m	f :m :r	d :- :s_1	d :- :-	- :- :d

mf

is no pie that the pie-mak-ers make Half so good as my mo-ther's pies. Oh, how I love the
is no cake that the cake-bak-ers bake Half so good as my mo-ther's cakes. Oh, how I love the
is no song that the song-sing-ers sing Half so good as my mo-ther's song. She sings a song of

	r :- :t_1	m :r :d	r :d :t_1	m :- :	s :- :m	r :d :t_1	d :- :l_1	s_1:-	*mf* m .f	s :- :s	s :- :s
	s_1 :- :s_1	s_1 :s_1 :s_1	s_1 :s_1 :s_1	s_1 :- :	s_1 :- :s_1	s_1 :fe$_1$:s_1	fe$_1$:- :fe$_1$	s_1:-	d .r	m :- :m	m :- :m
	t_1 :- :r	d :r :m	t_1 :d :r	d :- :	t_1 :- :d	t_1 :l_1 :s_1	r_1 :- :r_1	s_1:-	d	d :- :d	d :- :d

ap - ple - pie, The goose-ber - ry - pie, the cur - rant - pie! From sport and pas - time I would fly To
nice tea-cake, The cur - rant, sponge, and nice plum-cake! To eat a slice of mo-ther's cake I
Home so sweet, Where all in love to - ge - ther meet: I'd give up play the whole day long To

	l :- :s	s :- :m	f :s :f	f :- :r	f :- :m	m :- :s	d :- :d	d :r :m	f :- :m	r :m :f
	f :- :m	m :- :d	t_1 :t_1 :t_1	t_1 :- :t_1	r :- :d	d :- :t_1	d :- :l_1	s_1 :- :s_1	t_1 :- :d	t_1 :d :r
	d :- :d	d :- :d	s_1 :s_1 :s_1	s_1 :- :s_1	d :- :d	d :- :s_1	l_1 :- :f_1	m_1 :r_1 :d_1	r_1 :- :m_1	s_1 :- :

f

eat a bit of mo-ther's pie, To eat a bit of mo-ther's pie.
glad - ly would my play for-sake, I glad - ly would my play for-sake. *Symph. pp*
hear my mo-ther sing a song, To hear my mo-ther sing a song.

	s :- :l	s :f :m	f :- :s	f :- :r	m :- :d	r :m :f	m :- :r	d :-	*Symph. pp* s	l :- :l	s :m :d	m :- :r	d :-
	m :- :f	m :r :d	r :- :m	r :- :t_1	d :- :d	l_1 :s_1 :f_1	s_1:- :f_1	m_1:-	d	d :- :d	d :- :fe	d :- :t_1	d :-
	: :	: :	: :	: :	d_1 :- :m_1	f$_1$:m_1 :r_1	s_1:- :s_1	d :-	m_1	f_1:- :f_1	m_1:- :l_1	s_1:- :s_1	d_1:-

one-half its weight-number. On the air-scale the specific gravity of steam is $9 \div 14{\cdot}47$.

4. *Solubility.*

5. *Relation to Combustion.*—Not combustible, and not a supporter of combustion.

6. *Specialties.*—Special to steam, as compared with the two other forms of hydrogen oxide, though common to it and other gases, is its behaviour when subjected to heat. The coefficients of expansion—*i.e.*, the amount of expansion of unit volume when temperature is raised from 0° to 1°—are not variable in gases generally. This important fact renders calculations in regard to the volumes of gases, under varying temperatures, very easy. Experimentally the coefficient of expansion of ordinary cases is found to be ·003665, or $\frac{1}{273}$.

Thus 1 litre of gas at 0° becomes $1\frac{1}{273}$ at 1°
" " " " $1\frac{2}{273}$ at 2°
" " " " $1\frac{10}{273}$ at 10°
" " " " $1\frac{273}{273}$, or 2 at 273°
Thus 2 litres " become $2\frac{1}{273}$ at 1°
" " " $2\frac{2}{273}$ at 2°
" " " $2\frac{10}{273}$ at 10°
" " " $2\frac{2\times273}{273}$, or 4 at 273°

Calculations are more easily made by remembering that

273 volumes of gas at 0° become				274 volumes at	1°
"	"	"	"	275 "	2°
"	"	"	"	283 "	10°
"	"	"	"	546 "	273°
"	"	"	"	$273+x$ "	$(0+x)$°

and referring everything to 273 at 0°.

EXERCISES ON THE EXPANSION OF GASES (*solved*).

(54) What will be the volume of 455 cubic centimetres at 0° if the temperature is raised to 10°?

273 cc. at 0° become $(273+10)$ at 10°
1 " becomes $\frac{283}{273}$ at 10°
455 " become $\frac{283\times455}{273}$
$=\frac{283\times5}{3}=\frac{1415}{3}=471\frac{2}{3}$ cc.

(55) 15 cubic centimetres of a gas are measured off at 27°. What volume will they occupy at 0°?

273 at 0° become $(273+27)$ at 27°;
∴ 300 at 27° become 273 at 0°
1 " becomes $\frac{273}{300}$ at 0°
15 " become $\frac{273}{300}\times15$
$=\frac{273}{20}=13\frac{13}{20}$ cc.

(56) 4 litres of gas at 17° have their temperature raised 60°. What increase of volume occurs?

$(273+17)$ at 17° have a volume of $(273+77)$ at 77°
1 " has " $\frac{350}{290}$ at 77
4 " have " $\frac{350}{290}\times4$
$=\frac{35\times4}{29}=\frac{140}{29}=4\frac{24}{29}$;
∴ Increase of volume $=4\frac{24}{29}-4=\frac{24}{29}$ litre.

(57) 82 cubic centimetres of hydrogen at 55° are cooled down until they occupy a volume of 70 cubic centimetres. What is now the temperature?

Let x = number of degrees of final temperature.
$273+55$ or 328 at 55° become $273+x$ at x°
1 " becomes $\frac{273+x}{328}$ at x°
82 " become $\frac{(273+x)\times82}{328}$
$=\frac{273+x}{4}$

But $\frac{273+x}{4}=70$; ∴ $273+x=280$
$x=280-273$
$=7$°.

(58) 13 litres of gas at normal have their temperature raised to 21° and the pressure increased to 840 millimetres. What is now the volume of the gas?

273 at 0° under pressure of 760 mm. become 294 at 21°
1 " " 1 mm. becomes $\frac{294}{273}\times760$ at 21°
13 " " 840 mm. become $\frac{294\times760\times13}{273\times840}$
$=\frac{39}{3}=12\frac{3}{4}$ litres.

(59) $17\frac{1}{2}$ cubic centimetres of gas at −13 and under pressure 570 millimetres. What volume will they occupy at normal?

260 at −13° under pressure of 570 mm. become 273 at 0°
1 " " 1 " becomes $\frac{273\times570}{260}$ at 0°
$17\frac{1}{2}$ " " 760 " become $\frac{273\times570\times160}{260\times760\times9}$
$=14$ cc.

(60) What change of volume will 5 litres of gas undergo in being raised from −23° through 100°, whilst the original pressure upon them of 800 millimetres is reduced $\frac{1}{8}$?

250 at −23° and under pressure of 800 mm. become 350 at 77°
1 " " 1 " becomes $\frac{350\times800}{250}$ at 77°
5 " " 700 " become $\frac{350\times800\times5}{250\times700}$
$=8$. ∴ Change of volume $=8-5=3$ litres.

(61) 20 cubic centimetres of hydrogen are obtained at normal temperature and pressure. The pressure upon them is now doubled. To what temperature must they be raised that no alteration of volume may occur?

20 under pressure of 760 become 10 under double the pressure or 1520 mm.
273 at 0° become 546 at 273°
1 at 0° becomes $\frac{273}{20}$ or 2 at 273°
10 at 0° become 20 at 273°
∴ Required temperature is 273°.

EXAMPLES ON THE EXPANSION OF GASES.

(*For Solution*).

(51) Find the volume of 8 litres of a gas at 0° and 760 mm. when the temperature is raised to 20°.....$8\frac{146}{273}$ litres.

(52) 1 litre of gas is measured off at 13°C. and under a pressure =78 cm. of mercury. Calculate the volume at normal. .....
$979\frac{122}{273}$ cubic centimetres.

(53) 50 cc. of gas are obtained at 91°C. What will be the change of volume they undergo if the temperature is lowered $45\frac{1}{2}$° and the pressure is doubled?.....$28\frac{1}{4}$ cubic centimetres.

(54) Calculate the change of volume of 60 cc. of gas at normal when the temperature is raised to 312° and the pressure becomes 840 mm. .....$56\frac{1}{13}$ cc.

(55) 4 litres of gas are measured off at 800 mm. (temperature 234°). Find the volume at normal.....$2\frac{88}{117}$ litres.

(56) If a certain quantity of gas at 4° has the pressure upon it quadrupled, to what temperature must it be raised that its volume may not alter?.....835°.

(*To be continued.*)

MOTHER'S PIES.

T. CRAMPTON.

Gracioso.

1st TREBLE.
2nd TREBLE.

1. Of all the pies that the pie-mak-ers make—When the pie-mak-ers make their pies— There
2. Of all the cakes that the cake-bak-ers bake—When the cake-bak-ers bake their cakes— There
3. Of all the songs that the song-sing-ers sing—When the song-sing-ers sing their songs— There

BASS.

KEY G. *Gracioso.*

1st TREBLE. :n .f | s :- :l | s :f :n | f :s :f | n :r :d | r :n :f | n :- :r | n :- :- | :- :- :n
2nd TREBLE. :d .r | n :- :f | n :r :d | t_1 :t_1 :t_1 | d :t_1 :d | l_1 :s_1 :f_1 | s_1 :- :t_1 | d :- :- | :- :- :d
BASS. :d | d :- :d | d :t_1 :d | s_1 :s_1 :s_1 | d :r :n | f :n :r | d :- :s_1 | d :- :- | :- :- :d

mf

is no pie that the pie-mak-ers make Half so good as my mo-ther's pies. Oh, how I love the
is no cake that the cake-bak-ers bake Half so good as my mo-ther's cakes. Oh, how I love the
is no song that the song-sing-ers sing Half so good as my mo-ther's song. She sings a song of

r :- :t_1 | n :r :d | r :d :t_1 | n :- : | s :- :n | r :d :t_1 | d :- :l_1 | s_1 :- | *mf* n .f | s :- :s | s :- :s
s_1 :- :s_1 | s_1 :s_1 :s_1 | s_1 :s_1 :s_1 | s_1 :- : | s_1 :- :s_1 | s_1 :fe_1 :s_1 | fe_1 :- :fe_1 | s_1 :- | d .r | n :- :n | n :- :n
t_1 :- :r | d :r :n | t_1 :d :r | d :- : | t_1 :- :d | t_1 :l_1 :s_1 | r_1 :- :r_1 | s_1 :- | d | d :- :d | d :- :d

ap - ple - pie, The goose-ber - ry - pie, the cur - rant - pie! From sport and pas - time I would fly To
nice tea-cake, The cur - rant, sponge, and nice plum-cake! To eat a slice of mo-ther's cake I
Home so sweet, Where all in love to - ge - ther meet: I'd give up play the whole day long To

l :- :s | s :- :n | f :s :f | f :- :r | f :- :n | n :- :s | d :- :d | d :r :n | f :- :n | r :n :f
f :- :n | n :- :d | t_1 :t_1 :t_1 | t_1 :- :t_1 | r :- :d | d :- :t_1 | d :- :l_1 | s_1 :- :s_1 | t_1 :- :d | t_1 :d :r
d :- :d | d :- :d | s_1 :s_1 :s_1 | s_1 :- :s_1 | d :- :d | d :- :s_1 | l_1 :- :f_1 | m_1 :r_1 :d_1 | r_1 :- :m_1 | s_1 :- :

f

eat a bit of mo-ther's pie, To eat a bit of mo-ther's pie.
glad - ly would my play for-sake, I glad - ly would my play for-sake. *Symph. pp*
hear my mo-ther sing a song, To hear my mo-ther sing a song.

f *Symph. pp*

s :- :l | s :f :n | f :- :s | f :- :r | n :- :d | r :n :f | n :- :r | d :- | s | l :- :l | s :n :d | n :- :r | d :-
n :- :f | n :r :d | r :- :n | r :- :t_1 | d :- :d | l_1 :s_1 :f_1 | s_1 :- :f_1 | n_1 :- | d | d :- :d | d :- :fe | d :- :t_1 | d :-
: : | : : | : : | : : | s_1 | d_1 :- :n_1 | f_1 :m_1 :r_1 | s_1 :- :s_1 | d_1 :- | n_1 | f_1 :- :f_1 | n_1 :- :l_1 | s_1 :- :s_1 | d_1 :-

How I Teach Domestic Economy.

BY MRS. WIGLEY,

Authoress of 'Marshfield Maidens,' 'Our Home Work,' 'Workers at Home,' 'Royal Series Domestic Economy,' 'Cookery and Home Comforts,' 'The Merryweathers,' 'Thoughts,' etc.

CHAPTER I.

INTRODUCTION.

LET us begin with a laugh. We shall get on all the better afterwards.

Once upon a time a certain captain of a newly-organised rifle corps went forth to drill the awkward squad. He was earnest and determined, and moreover his stock was of the stiffest, his uniform of the newest, and his military experience of a youthful cast.

Well, among the men stood Jones, a weak, little, thin man, with a patriotism almost too big for his body, who was determined to master all and everything now he *was* in for it.

Of course he made mistakes while the sergeant endeavoured to marshal them into something like order before the august captain. Whoever *could* tell which was their right or their left side if suddenly asked? At last they were ready, and the first order was issued in stentorian tones, 'Bor, bas, boo! bor, bor, buff!"

Jones stood aghast. 'What's he say?' he whispered timidly to his companion. 'I'm sure I don't know,' said the other, '*only we have got to do it.*'

We can all sympathize with poor Jones. We, too, have now and again received orders from headquarters of which we have understood quite as much as the volunteer did of those given to him. It is some comfort to know that we *could* do it fast enough if only we can get to understand what 'Bor, bor, buff,' may mean.

I am privileged in these papers to aim at making clear one of these 'Bor, bor,' requisitions. Plain enough, necessary enough, and reasonable enough, and yet difficult to many because not clearly understood. And I must ask you to remember that it is only for those that I am writing at all. I am not forgetting the old proverb which sets forth the wisdom of certain grandmammas in connection with eggs. My aim is to bring my experience to the aid of those who have not any of their own in this particular matter.

Now we will get to work.

Domestic Economy! It is impossible for any of us as conscientious teachers to remain altogether indifferent to the sight or the sound of those two words. It is not of much consequence whether we are adepts in the science and have the whole business at our finger-tips, or whether we are in a state of sublime and very superior ignorance of the entire affair. We *cannot help* being stirred and moved at least in some small measure, whenever these words come to our eyes or our ears.

For Domestic Economy is the science which teaches the right management of all connected with the health, the happiness, and the prosperity of *Home* and its inmates. (Please observe, I write 'Home' with a capital; surely this word should always be the *most proper* of all nouns.) Any science which teaches *Home management* is essentially *a girl's science*, and becomes at once a matter of especial interest to us, as teachers of girls.

More than once during the past year I got quite a shame-faced feeling respecting this famous subject. Let me tell you what were the occasions.

We all heard about the Domestic Economy Congress. I was kindly invited to take some part in its proceedings, but though I was unable to attend I watched the 'talkee-talkee' with no ordinary interest. I coached up myself in all its proceedings by means of the daily papers and reports, and I am afraid the secretary named me her 'irrepressible correspondent.'

And when it was all done, what conclusions did those earnest, well-informed enthusiasts in the cause arrive at and send forth to the world? Nothing less than this: 'That the teaching of the subject in our schools was almost a failure—that the children got theory, and not practice; that they gained grants, but not experience; and *that teachers generally looked with disfavour on such teaching altogether.*'

It was this which made my face burn, and sent an impatient ejaculation to my lips and produced *a sensation.*

Soon after this I was privileged to speak with a gentleman who has done very much to extend useful knowledge among girls and women. This was the Vice-President of the South Kensington Cooking School, R. C. Browne Clayton, Esq. At the present time this gentleman entirely supports a movable cooking school. He pays the salary of a trained South Kensington teacher, and sends her from place to place to give lessons in domestic matters to our elementary school girls, wherever such lessons are welcomed and valued. And besides this, he sends with her all the apparatus necessary for the actual practice of the lessons given—stoves, pots, pans, sieves, and all the numerous articles and tools necessary to produce good work. These things are packed in large crates, and make their appearance along with the teacher. The lessons are given entirely free of charge; all that is asked is a building or room of some kind wherein to work. The mountain would not come to Mahomet, you know, and so Mahomet went to the mountain.

Well, I asked this gentleman what was the result of his benevolent effort, after three or four years' trial. This was his answer: 'I cannot say the work is as successful as I wish it to be. It does great good, I have no doubt, *but the teachers don't like it.* It interferes with other school work, and they rather resent any one else teaching their children.' And this gave me a *second* sensation.

And I got yet a third. I had been reading something Earl Spencer said in answer to a Domestic Economy deputation which waited on his lordship and Mr. Mundella, in order to petition that the teaching of Domestic Economy in our girls' schools might be made compulsory in the new Code.

This is the substance of what I read. The teaching of the subject had certainly not been a great success in very many places, while in still more it was not taught at all. *The great thing wanted was the hearty co-operation of the teachers.* His lordship was not at all sure that they had not begun at the wrong end in commencing with the children. It would be a good thing in future if some plan could be devised for securing skill in the teachers. When teachers had a practical knowledge of the subject, there would no longer be any difficulty in getting the scholars taught.

Now there is a good deal of truth in this. We all

know that we have a great pleasure in imparting knowledge on any subject in which we feel ourselves to be A 1. And we know also that what is popular with the TEACHER, is sure also to be popular with the SCHOLAR. We cannot help our children thinking as we think about most things. They look up to us and believe in our wisdom above all: if the Teacher says so, there's an end to all doubt. Nay, we have heard it asserted many a time that it is impossible for a teacher *not* to stamp *herself* on the mind of the child she instructs. A lesson may be given clearly and well, and not one item remain in the little mind, while in some mysterious way *that which the teacher is*, will pass from her *as an invisible essence*, and do its work in influencing, moulding, and shaping the characters of the plastic little people who listen to her voice.

This is a most solemn thought to us. The knowledge of such a truth does more to convince us of the mightiness and importance of our work than almost any other.

Well, now, as regards Domestic Economy. This is the science, we said, which has so much to do with *the health*, *the happiness*, and *the prosperity* of the Home. Our girls will have more need for a knowledge of this than of any other thing under the sun. *And the need will last as long as their own lives.* How many things do we place in their school curriculum, which we take immense pains to teach them, to which they never give a passing thought when they leave our care, and *this one* is very often left altogether out in the cold.

Girls ought to learn the management of the Home. *We all agree to that.* Mothers are the proper persons to teach the subject. *We are agreed about that also.* But if we go a step further and say, when the mothers fail to do their work, let the teachers step in and stand the children's friend, *then we don't agree any longer.* A great many people think that the school is not the place for this kind of work, nor the teacher the proper person to teach it.

But why? It is a mother's place to teach her child everything good; but if the mothers neglect their offspring, our hearts are all the more stirred with pity for the little forlorn ones, and we yearn over them, and in all other matters we seek to make up the deficiency. Why, then, do we so hold back in this matter? There was a young teacher only a short time back who received the Albert Medal from Her Majesty for her heroism in rescuing some little children from disaster or death by lugging them out of the ruins of a room which had fallen on them. She did this at her own imminent risk. Was she the proper person to care for their bodies, or did *she like* the dust and the dirt and the smother she had to face in doing as her heart prompted? Of course we know she thought only of the children's good in what she did, and of course also there are hundreds and hundreds of women who unhesitatingly have done, and are doing the like over and over; thinking of their children's good, and not once of their own, and whose names are recorded on high among God's heroes.

It is the mother's place to teach domestic excellence to their daughters. Yes.

Only too many mothers of the present generation don't know the lesson themselves, so they cannot do it.

What then? Why just this. The teachers have the power of altering this in time to come, because those teachers are now educating the mothers of the next generation. If we will, then, we may do a great deal to put this wrong thing right. We may to-day so train our girls, so teach them by theory, practice, and by example, that all such lessons may once again pass into the right hands and be carried out in the right place, and if we can do this, don't you think the teachers of to-morrow will rise up and call us blessed?

Why should any woman show a dislike to this *grand* woman's science? Especially why should an *educated* woman do it?

'I don't dislike it,' perhaps some one may be thinking; 'I can turn out as nice a cake or as delicate a dish of pastry as here and there one;' 'I can exercise real skill in more than one matter connected with Home, I can tell you.'

I quite believe you. Many, many things are all the better for your touch and tending, and you like to do these things. You are proud of the lightness and puffiness of your dainties when those qualities bespeak excellence; and this brings just the answer I wanted to my question. The things we can *do well* from practice or natural skill and aptitude, *we take a delight in doing;* but those at which we are awkward and unsuccessful, and which do us no credit, we had very much rather let alone altogether.

I dare to say that if every teacher of girls was a *skilled labourer* in all woman's work, we should find those girls taking delight in every little detail by which such work could be brought to perfection. And as educated women—women of dainty refinement, as well as of healthy, unselfish energy—it is in our power to ennoble, aye, and *to beautify*, the very commonest of those details.

Once I heard Mr. Buckmaster say, 'When ladies undertake the work of a house, we shall have such work *elegantly and beautifully performed with elegant and beautiful tools.*' AND SO WE SHALL!

As long as the educated—the beautiful and the elegant too, if you like—look down on all such work as drudgery, fit employment only for those lower down in the social scale, then it will be done *anyhow*, with *anything*, and by *anybody*.

And what is all this rigmarole to lead to? Why, just this: those who want to turn out skilled workers must be skilled workers themselves. I hope the day may come and I may live to see it, when every girls' school in the land may have attached to it a liliputian department, where a woman's practical science may be carried on, where a teacher may show how daintiness and neat-handedness, and a nice appearance too, are quite compatible with brooms and brushes, and pots and pans.

I am an old Domestic Economy Teacher—perhaps I am the oldest. When I began my efforts to master the subject, I was as unskilful and as ignorant as it was possible for any one to be. Talk about blunders and mistakes! 'I could a tale unfold.' And yet now I am able to write from the outcome of a very large experience as a *successful* teacher.

My dears, there's a tuft of grey hairs growing out over my bump of benevolence, which might have been black ones to this day but for Domestic Economy. Respect my grey hairs, then, and let me show you how I should carry out a course of lessons in this subject of subjects.

(To be continued.)

Recent Inspection Questions.

[The Editor respectfully solicits contributions—all of which will be regarded as STRICTLY PRIVATE*—to this column. For obvious reasons, it cannot be stated in which district the questions have been set.]*

Arithmetic.

STANDARD I.

(All dictated.)

96	703	80	3×9 = 27
840	697	700	4×8 = 32
9	6	19	5×7 = 35
768		680	6×12 = 72
900		809	
2613		2288	

STANDARD II.

(Dictated.)

80,040	78,965×790 = 62,382,350	96,785
9,067	70,001÷8 = 8750+1	8,000
70,973		77,906
		89,098
		919
		80,760
		353,468

STANDARD III.

(On cards, mostly in words.)

(1) If 750,535 persons visited the Crystal Palace in 47 days, how many went in one day?
Ans. 15,968+39.

(2) If your brother has 17s. 6d. and you have 7 sixpences and three halfpence, who has the most, and how much has he more than you?
Ans. My brother has 13s. 10½d. more than I have.

(3) If a boy took out of his money-box 3s. 6¾d. six times, how much would he have left out of five pounds?
Ans. £3 18s. 7½d.

(4) If a train travelled seven hundred thousand six hundred and twenty-three miles in 99 weeks, how many miles would it travel in a week?
Ans. 7077 miles.

STANDARD IV.

(Card A.)

(1) If I drink half a pint of milk twice a day, and half a pint of beer at my supper, the milk being a penny a half pint, and the beer 1¼d. a half pint, what will they cost me a year?
Ans. £4 18s. 10¼d.

(2) What is the ninth part of eight millions six thousand and nineteen pounds, and eleven pence farthing?
Ans. £889,557 13s. 5¼d.

(3) Multiply £7028 11s. 0¼d. by 93.
Ans. £653,655 4s. 11¼d.

(4) There are 89 tenants who pay me £70,012 14s. 3¼d., what does each pay?
Ans. £786 13s. 2¼d.+28.

(Card B.)

(1) If 86 houses cost £97,006 0s. 11½d., find the cost of one.
Ans. £1127 10s. 6¼d.. 18 over.

(2) If three hams weigh 34 lbs. each, and each bone weigh 5 ozs., how many persons could dine off them, ea chhaving 4 ozs.?
Ans. 404.

(3) Find the seventh part of £1,700,269 and 9d.
Ans. £242,895 11s 6¼d.+5.

(4) A tradesman sells goods to the value of £1085 17s. 9¼d. a week. Calculate his sales in 4 years.
Ans. £225,864 16s. 4d.

STANDARD V.

(Card A.)

(1) A man works 42 hours for 3 guineas, how much would he earn if he worked 7 days at 8 hours per day?
Ans. £4 4s.

(2) Make out a bill of the following goods:—¾ lb. soap at 5¾d. per lb., 93 pots of jam at 5d. each, 150 eggs at 2 for 1½d., 5½ dozen at 2s. 4½d. per dozen, 6 dozen at 1s. 1½d. per doz.
Ans. £3 8s. $3\frac{9}{16}$d.

(3) Add ½, ⅔ and ⅗ together, and substract ⅓ from the sum.
Ans. $1\frac{31}{60}$.

(4) 9807 articles at 19s. 1d. each.
Ans. £9357 10s. 3d.

(Card B.)

(1) ⅔−⅓+½+⅘.
Ans. $1\frac{19}{210}$.

(2) If 12 pennies cover 22 sq. inches, how many will it take to cover half an acre?
Ans. 1,710,720.

(3) 150 eggs at 2 for 1½d., 6 ozs. of tea at 4s. per lb, ¼ cwt. sugar at 5d. per lb., 78 oranges at 9d. per doz.
Ans. £1 7s. 5d.

(4) 31 sq. yds., 6 ft. 72 in., at £1 19s. 6d. per sq. yd.
Ans. £62 13s. 0½d.

Dictation.

STANDARD I.

Stood, field, because, small, father, please, lady, street, mutton, jump.

STANDARD II.

But no sign of any treasure appeared, and they set themselves down as having been played with. When next year came, however, they saw with wonder that every vine bore threefold, and that the clusters were far finer than those of any other vineyard round. They then saw what their father had meant.

STANDARD III.

The Spring leads us to expect a great deal, besides, that is charming and lovely. For what is noble and great only flourishes where modesty and humility dwell.

Maria now found a full-blown violet on the road-side among thorns, but a dew-drop shone on the blue cup of the flower, and bent it down with its weight.

STANDARD IV.

James never had much discretion, and, to please his new subjects, he lavished titles on large numbers of men during the first three months of his reign, so that

everybody laughed at him and his new knights. Perhaps you will better understand all about the religious disturbances of these times if I tell you, in as few words as I can, how matters stood. When England threw off the Catholic religion, there was a very great difference of opinion among the cleverest men about what should be the exact nature of the new faith.

STANDARDS V. AND VI.

An extract from a newspaper brought by the examiner was given, and contained the following words:—Oriental, inauguration, festoons, cathedral, wreaths, performances, festival, festivities, surpassed.

Geography.

Oral in all the Standards I. and II. on definitions of geographical terms. III.—England—railways and their London termini—manufactures—mountains, etc. IV., V., and VI.—Europe—boundaries—islands—principal towns—birthplaces of celebrities, etc. Maps shown.

Grammar.

STANDARD II.

To write out on paper the nouns and verbs from eight lines of prose selected from one of the reading-books used in the standard.

(The piece contained 20 nouns and 26 verbs.)

STANDARD III.

Examination entirely oral, and consisted of questions on the nature of Nouns, Adjectives, Pronouns, Verbs, and Adverbs, the various kinds of each, and specimens of each kind, with sentences containing them.

STANDARD IV.

To parse (on paper) the sentence:—'At church his looks adorned the venerable place.'

STANDARDS V. AND VI.

To parse and analyse (on paper):—'His ready smile a parent's warmth expressed.'

—o—

The 'Practical Teacher' Prize Competition

FOR MALE AND FEMALE PUPIL TEACHERS.

THE Editor of the PRACTICAL TEACHER has pleasure in announcing that money prizes will be given to Pupil Teachers (Male and Female) who furnish the best answers to the following Examination Papers. The Prizes will be divided as follows:—

FIRST YEAR...	First Prize	*Half-a-guinea.*
	Second „	*Five Shillings.*
SECOND „ ...	First „	*Half-a-guinea.*
	Second „	*Five Shillings.*
THIRD „ ...	First „	*Half-a-guinea.*
	Second „	*Five Shillings.*
FOURTH „ ...	First „	*Half-a-guinea.*
	Second „	*Five Shillings.*

The following are the conditions of the competition:—

1. This competition is restricted to subscribers to the PRACTICAL TEACHER.

2. Pupil Teachers must answer questions set for their own year only.

3. Questions must be answered on foolscap paper only, and *each page* of the answers must contain a pseudonym selected by the candidate.

4. All answers must be sent to the Office of the PRACTICAL TEACHER, Pilgrim-street, Ludgate-hill, London, E.C., by the 15th of March.

5. No papers sent in can be returned.

6. Each set of answers must be accompanied by a letter containing the real name, address, and year of apprenticeship of the candidate, together with the following declaration, signed by the candidate and attested by the master, or the mistress, or some other respectable person to whom reference may be made if necessary:—

'I, , hereby declare that I am a subscriber to the PRACTICAL TEACHER, and that the accompanying answers are my own work, that they have been written within the time specified at the head of the papers, that I have not received any assistance from books or otherwise since the perusal of the questions, and that I have conformed to the terms of the competition to the best of my knowledge and belief.'

Signed
Pupil Teacher of , Year.

'The above declaration was made before me, and the papers were worked in my presence, and the terms of the competition have been faithfully complied with to the best of my belief.'

Signed

The list of prize winners will, if possible, be given in the April number of the PRACTICAL TEACHER.

—o—

THE 'PRACTICAL TEACHER'

Prize Competition for Pupil Teachers.

Examination Papers.

FIRST YEAR.

Three hours and a half allowed.

Arithmetic.

MALES.

1. What must be added to

$$\frac{\frac{1}{4}-\frac{1}{8}}{\frac{1}{4}+\frac{1}{8}} \times \frac{9\frac{1}{2}-5\frac{1}{2}}{4\frac{1}{2}+3\frac{1}{2}} \div \frac{32\frac{3}{8}-20\frac{1}{4}\frac{1}{8}}{10\frac{3}{8}+3\frac{1}{16}}$$

to make the total $8\frac{1}{2}$ of $\frac{3}{5}$ of $4\frac{1}{16}$?

2. From a field containing 4·25 acres $\frac{1}{16}$ of an acre was fenced off, and the remainder marked out into 18 plots; how many sq. poles did each contain?

3. If a wheel is 9·147 ft. in circumference, how many turns will it make in travelling 45·670971 miles?

4. Two horses and a carriage are worth £210, the carriage being worth $\frac{2}{3}$ of $\frac{3}{5}$ of this amount; find the value of each horse, supposing one to be worth one-fourth as much again as the other.

FEMALES.

1. Find (by practice) the cost of 288 articles at £1 19s. 11½d. each in the shortest way you can.

2. How much would the paving of a street, 2 m. 20 poles in length, cost at £72 14s. per furlong?

3. A grocer wishes to make up equal quantities of tea in 4, 5, 6, 7, 9, 12, 15, 20, 25, and 35 lb. parcels. What is the smallest quantity which will allow him to do this?

4. Make out and receipt a bill for the following:—

6 yds. silk at 8s. 4½d. per yard.
27 yds. muslin at 2s. 10½d. „
4½yds. calico at 11d. „
6¾yds. linen at 10½d. „
½ gross buttons at 1s. 1½d. per doz.
2 yds. satin at 4s. 7¾d. per yd.

Grammar.

MALES AND FEMALES.

1. Parse the sentence—
Great is he who uses his greatness for all.

2. Analyse the following passage :—

It was a summer's evening,
Old Kaspar's work was done,
And he before his cottage door
Was sitting in the sun ;
And by him sported on the green
His little grandchild—Wilhelmine.

3. What do you mean by the infinitive mood? Give examples of its various uses.

4. Write six English nouns, six adverbs, and six adjectives formed from roots or primary words by means of affixes. Distinguish between the affix and the root.

Geography.

1. Draw a map of the eastern half of Australia, marking the chief physical and political features.

2. Name the rivers of Scotland, and give a description of two which you think the most important.

3. What are the chief productions and exports of the various divisions of Australia?

History.

1. Explain briefly the following terms :—Bretwalda, Druids, Heptarchy, Adrian's Wall, Foss Way, Watling Street, Danegelt.

2. Give a short description of the dress, dwellings, weapons, food, and trade of the inhabitants of Britain at the time of the Roman invasion.

3. Write a short account of the reign of Edward the Confessor.

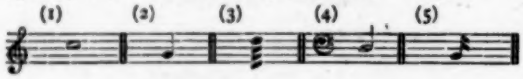
Music.

OLD NOTATION.

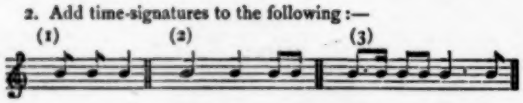
A quarter of an hour allowed for this paper.

(N.B.—Pupil Teachers may answer the questions in either the Staff Notation or the Tonic Sol-fa, but *not both*. The questions in the Tonic Sol-fa Notation will be found at the end.)

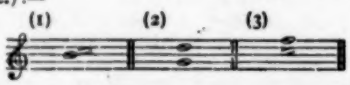
1. Write above each of the following notes its value-name (quaver, &c.), and below each its pitch-name (C or Doh):—



2. Add time-signatures to the following :—



3. Write below each of the following intervals its name (major second, &c.) :—



TONIC SOL-FA NOTATION.

1. Write the names of following intervals :—(1) *te* to *doh*^{1}; (2) *soh* to *ray*^{1} ; (3) *doh*^{1} to *fah*^{1}.

2. Write (1) a six-pulse tone using three-pulse measure, and (2) a six-pulse tone using two-pulse measure.

3. What is meant by (1) "Key G"?
Write the following an octave higher :—

$$|s_1 :d :r |f :l :s |t_1 :d_1 :d \|$$

Needlework.

FEMALES.

(One hour only must be given to the Exercise in Needlework.)

Join two pieces of calico (each 3½ inches square) together by seam and fell. Gather, stroke, and set in one joined end into a band. Hem the bottom, and sew on a tape string (2½ inches long).

SECOND YEAR.

Three hours and a half allowed.

FIRST PAPER.

Euclid.

MALES.

1. To describe a triangle whose sides shall be equal to three given straight lines, but any two of which must be together greater than the third.
Why is it necessary to add the last clause?

2. If two angles of a triangle be equal to one another, the sides also which subtend or are opposite to the equal angles are equal to one another.
Of what proposition is this the converse?

3. Place a straight line of given length between two straight lines which meet, so that it shall be equally inclined to each of them.

Arithmetic.

FEMALES.

1. What is the value of $\frac{3}{4}$ of two guineas + $\frac{7}{8}$ of 3s. 4d. + $1\frac{1}{3}$ of half a sov. + $\frac{4}{15}$ of 3s. 9d. + $\frac{10\frac{1}{2}}{12}$ of a groat?

2. A tea-dealer having $\frac{3}{7}$ of 2 cwt. 9½ lbs. of tea, sold at different times $\frac{1}{28}$ cwt., $\frac{3}{14}$ qr., $\frac{1}{8}$ of 3 qr., $\frac{1}{168}$ ton, $\frac{3}{4}$ of $\frac{1}{2}$ cwt., and $\frac{3}{8}$ of $\frac{7}{11}$ of $\frac{75\frac{3}{4}}{112}$ cwt. What quantity had he left?

3. Express as decimals :—$\frac{1225}{10000}$, $\frac{37}{1000}$, $\frac{14}{20}$, $\frac{1078}{333}$, $\frac{1}{83}$.

4. What number is that of which 76 is $\frac{4}{5}$, and what fraction is that of which $\frac{2}{3}$ is $\frac{4}{5}$?

Grammar.

MALES AND FEMALES.

1. Analyse fully :—

Even now *where* Alpine solitudes ascend,
I sit *me* down, a pensive *hour to spend* ;
And *placed* on *high* above the storm's career
Look downward where a hundred realms *appear*.

2. Parse the words in italics, paying special attention to the syntax.

3. Give the meaning of the following prefixes, with three examples of the use of each :—
Trans, ultra, retro, in (with verb), ex, semi, subter.

4. Paraphrase :—

A time there was ere England's griefs began,
When every rood of ground maintained its man :
For him light labour spread her wholesome store,
Just gave what life required, but gave no more.

Geography.

1. Say what you can of (1) the Deccan, (2) the Alps.

2. Draw a map of Italy.

3. What are *latitude* and *longitude*? Say from what places they are reckoned, and, if you can, how they are calculated.

SECOND PAPER.

Two hours and a half allowed.

Needlework.

FEMALES.

(One hour only must be given to the Exercise in Needlework.)

Make a band with calico ; on it work a button-hole, set on a button, and hem, whip, and set on a frill.

Arithmetic.

MALES.

1. What sum of money will amount to £350 19s. 4½d. in 6½ years at 4½ per cent per annum?

2. Work as a compound proportion question the following :—Find the interest of £500 for 3½ years at 2½ per cent. per annum.

3. A bill of £999 is due in such a time that £80 would in the same time amount to £83½. What discount should be allowed for ready money?

4. A newspaper boy buys papers at 9d. per dozen, getting thirteen to the dozen. If he sells them at a penny each, what is his gain per cent.?

History.

1. What changes were effected in the condition of the English people after the Norman Conquest?
2. What were the causes which led to the signing of Magna Charta? Name its chief provisions, and say whether they are or are not still in force.
3. What important geographical and other discoveries were made in the Tudor period?

Teaching.

Name the common faults you have met with in the writing of your class, and say how you have corrected them.

Music.

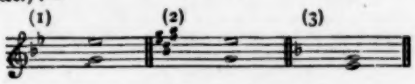
OLD NOTATION.

A quarter of an hour allowed for this paper.

(N.B.—Pupil Teachers may answer the questions in either the Staff Notation or the Tonic Sol-fa, but *not both*. The questions in the Tonic Sol-fa Notation will be found at the end.)

1. Write the key-signature of the following major keys:—(1) B♭; (2) B; (3) A♭; (4) F♯.

2. Write below each of the following intervals its name (major third, &c.):—



3. Add time-signatures to each of the following:—

TONIC SOL-FA NOTATION.

1. Write the names of the following intervals:—(1) *lah* to *fah*'; (2) *te* to *soh*'; (3) *te* to *ray*'.

2. What are the mental effects of (1) *lah*; (2) *me*; (3) *ray*; (4) *fah*?

3. Write a short exercise in six-pulse measure.

THIRD YEAR.

FIRST PAPER.

Three hours and a half allowed.

Euclid.

MALES.

1. If a straight line falling on two parallel lines make the alternate angles equal to one another, the two straight lines are parallel to one another.
Explain *alternate angles, problem, theorem.*
2. To describe a square on a given finite straight line.
3. If any point P be joined to A,B,C,D, the angular points of a rectangle, show that the squares on PA and PC are equal to the squares on PB and PD.

Algebra.

1. Simplify:—
$$\{2a-(3b+c-2d)\}-\{(2a-3b)+(c-2d)\}+\{2a-(3b+c)-2d\}-\{(2a-3b+c)-2d\}$$
2. Give the rule for finding the G.C.M. of two or three quantities; and find the G.C.M. of
$$x^4-2x^3+x^2-8x+8, \text{ and } 4x^3-12x^2+9x-1.$$
3. Solve:—
$$(1)\ \frac{x+4}{3x+5}+1\tfrac{1}{2}=\frac{3x+8}{2x+3}.$$
$$(2)\ \frac{x-4}{x-5}-\frac{x-5}{x-6}=\frac{x-7}{x-8}-\frac{x-8}{x-9}.$$

Mensuration.

1. A ladder 50 feet long, with its foot in the street, will reach to the top of a building 40 feet high on one side, and to the top of another 27 feet high on the opposite side. Find the width of the street.

Arithmetic.

FEMALES.

1. Add together 5·36 of £1 7s. 1d., 95·1725 of £2 18s. 4d., and ·0015625 of £39 6s. 8d.
2. If a man does ·008 of a piece of work in 3·2 hours, in how many more hours will he finish it?
3. If 5 tons 13 cwt. of coals cost £6 7s., what will 111 cwt. be worth?
4. Simplify:—
$$\frac{(\cdot75-\cdot61)\,(1\cdot6744+\cdot4256)}{\cdot428571 \text{ of } 1\cdot\dot5}\div\frac{1\cdot4}{6\cdot\dot4}.$$

Grammar.

MALES AND FEMALES.

1. Paraphrase the following passage:—

Ill fares the land to hastening *ills* a *prey*,
Where wealth accumulates and men decay;
Princes and lords *may flourish or* may fade;
A breath can make them, as a breath *has made;*
But a bold peasantry, their country's *pride*,
When once *destroyed, can* never *be supplied.*

2 Analyse it fully.
3. Parse the words in italics, and state clearly how you may tell an adverb from a conjunction, with examples.
4. How can you distinguish English words from Latin or other foreign words?

Geography.

1. Draw a full map of the Nile basin.
2. Explain, as to an upper class, the causes of the monsoons, and state what phenomena attend the changes of the monsoons.
3. Which are the most thickly peopled countries of Asia? Give an account of the trade and the inhabitants of each.

SECOND PAPER.

Two hours and a half allowed.

Needlework.

FEMALES.

(One hour only must be given to the Exercise in Needlework.)

Set in a triangular patch in flannel about three inches each way; on it darn ten rows as for a thin place.

Arithmetic.

MALES.

1. Find the square root of $\frac{4}{9}$, and prove that $\sqrt{5}\times\sqrt{5}=5$.
2. What fraction of £5 is the excess of $\frac{3}{4}$ of £2 over $(\frac{1}{2}-\frac{1}{4})$ of $\frac{2}{3}$ of £2 10s.?
3. Explain what is meant by losing 2 per cent. on a transaction in stocks. Find the yearly income from £2500 invested in 3 per cents. at 98¼, brokerage to be reckoned.
4. Divide 623 into three parts, so that the 1st : 2nd as 4 : 7, and the 2nd : 3rd as 3 : 8.

History.

MALES AND FEMALES.

1. What is meant by the National Debt? Give the circumstances under which it was first commenced.
2. Show by a table how William III. was connected with the Stuarts and the Tudors.
3. What is a Convention Parliament? Give the dates of all you know, with a full description of any one of them.

Teaching.

Write notes of a lesson on *Water* or *Air*.

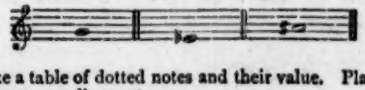
Music.

OLD NOTATION.

A quarter of an hour allowed for this paper.

(N.B.—Pupil Teachers may answer the questions in either the Staff Notation or the Tonic Sol-fa, but *not both*. The questions in the Tonic Sol-fa Notation will be found at the end.)

1. Write perfect fifths above the following notes:—



2. Make a table of dotted notes and their value. Place beside each the corresponding rest.

3. Explain briefly the following terms:—(1) *Andante*; (2) *Crescendo*; (3) M. 60; (4) *Allegro*.

TONIC SOL-FA NOTATION.

1. Write perfect fifths above the following notes:—(1) *soh*; (2) *ma*; (3) *le*.

2. Re-write the following in four-pulse measure, doubling the value of every note and rest:—

|s ,l .s ,f :m . |s ,l :r ,t |d :r .f |m : ||

3. Explain briefly the following terms:—(1) *Andante*; (2) *Crescendo*; (3) M. 60; (4) *Allegro*.

FOURTH YEAR.

Pupil Teachers at end of Fourth Year.

FIRST PAPER.

Three hours and a half allowed.

Euclid.

MALES.

[All generally understood abbreviations for *words* may be used.]

1. If a straight line be divided into any two parts, the sqs. on the whole line and on one of the parts are equal to twice the rectangle contained by the whole and that part, together with the sq. on the other part.
2. To describe a sq. that shall be equal to a given rectilineal figure.
3. Prove that the sum of the sqs. on the two parts of any line is least when the sqs. are equal.

Algebra.

1. Find the value of

$$\frac{a^3-3a^2b+3ab^2-b^3}{a^2-b^2} \div \frac{2ab-b^2}{3} \times \frac{a^2+ab}{a-b}.$$

2. Simplify:—

$$\frac{\sqrt{x^2+1}+\sqrt{x^2-1}}{\sqrt{x^2+1}-\sqrt{x^2-1}} + \frac{\sqrt{x^2+1}-\sqrt{x^2-1}}{\sqrt{x^2+1}+\sqrt{x^2-1}}.$$

3. Solve the following equations:—

(1) $ax=by$
$x+y=c$.

(2) $(x+2)^2=4x+5$.

(3) $x^2+\frac{1}{12}x=145$.

Mensuration.

The area of a circular plot of ground is one acre; what would be the area of the largest square plot of ground which could be cut out of it?

Arithmetic.

FEMALES.

1. At 2½ per cent. per annum find the sum of the interest on £80 for 2½ years, and £750 for 3½ years.
2. Twenty-five cwt. of metal are obtainable from 470 tons of ore from one mine, and 16 tons 18 cwt. from 329 tons of ore from another mine. Find how much higher a percentage of metal can be got from one than the other.
3. Find the present worth and discount of £8984 5s. due at the end of 6 years at 3½ per cent. per annum.
4. By selling 7 cwt. 2 qrs. of sugar at 6½d. per lb. a grocer made a profit of 35 per cent. What did it cost him per cwt.?

Grammar.

MALES AND FEMALES.

1.

What time the mighty moon was gathering light,
Love paced the thymy plots of Paradise,
And all about him rolled his lustrous eyes;
When, turning round a cassia, full in view,
Death, walking all alone beneath a yew,
And talking to himself, first met his sight;
'You must begone,' said Death, 'these walks are mine.'

Analyse fully the above passage.

2. Paraphrase the above passage.
3. Give the names of the principal writers of the 'Augustan' age of English Literature, with the chief works of any one of them.
4. Give the etymology and the various meanings of the following words:—Kinsfolk, literature, maintenance, manifold, misfortune, munificent, sensation, seclusion, transmit, treacherous.

Geography.

1. Write what you know about the moon.
2. Describe the physical features of the Soudan, naming also its various divisions, chief towns, and saying what you can of its inhabitants.
3. Compare the Atlantic and the Pacific Oceans.

SECOND PAPER.

Two hours and a half allowed.

Needlework.

FEMALES.

(One hour only must be given to the Exercise in Needlework.)

Set in a calico patch about three inches square, and mark on it the letter K and the figure 5.

Arithmetic.

MALES.

1. A landlord having a farm of 102 acres, previously let at £2 an acre, thrown on his hands, lets it out in 3-rood lots at 15s. a rood, and a bushel of potatoes for every lot. If he increases his income by £340, what is the value of potatoes per bushel?
2. In a school of 1400 children 56·25 per cent. are girls, who earn $\frac{7999}{15555}$ of a grant of £1400. If the number of failures of the boys be 7 per cent., what is that of the girls?
3. In how many years would 1d. amount to £1 at 10 per cent. per annum?
4. What is the insurance on £12,000, if I so insure as to save the premium as well as the property in case of loss?

History.

MALES AND FEMALES.

1. What are the advantages and disadvantages connected with England having such a large colonial empire.
2. Give an account of the changes in the representation of the people during the present century.
3. What led to the loss of the American colonies in the reign of George III.?
4. Name, in order of date, a dozen of the chief events of the reign of Victoria.

Teaching.

Write notes of a first lesson on Subtraction for Standard II., or Long Division for Standard III.

Music.

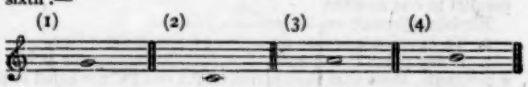
OLD NOTATION.

A quarter of an hour allowed for this paper.

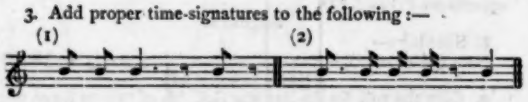
(N.B.—Pupil Teachers may answer the questions in either the Staff Notation or the Tonic Sol-fa, but *not both*. The questions in the Tonic Sol-fa Notation will be found at the end.)

1. Write in the Bass clef the ascending scale of E♭ minor, using the sharp sixth and seventh.

2. Write above (1) an augmented fifth; above (2) a diminished or minor fifth; above (3) a perfect fourth; above (4) a major sixth:—



3. Add proper time-signatures to the following:—



TONIC SOL-FA NOTATION.

1. Write (1) above *soh* an augmented fifth; (2) above *doh* a diminished fifth; (3) above *lah* a perfect fourth; (4) above *te* a major sixth.

2. Write the following in two-pulse measure by dividing the value of each note by three:—

|s :d :— |l :m :s |r :— :m |d :— :— ||

3. Say what are the points of difference between the *doh* and the *lah* modes, and give the various forms of the latter.

Query Column.

RULES.

1. Each correspondent is restricted to *one question*. We should be much obliged if correspondents, who send questions for solution, would give (if possible) the required answer, and the source from which the question is obtained.

2. No query can be answered unless accompanied by the real name and address of the sender, not necessarily for publication, but as a guarantee of good faith and for facility of reference.

3. ☞ When a pseudonym is adopted it should be written at the end of the query, and the real name and address on a separate piece of paper.

4. Correspondents are requested to write their queries *legibly*, and on one side of the paper only.

5. Replies will not be sent through the post.

6. Queries must reach the office *not later than the 12th of the month*, or they cannot be attended to in the following issue.

*** All communications for this column should be addressed—'*The Query Editor*,' *The Practical Teacher*, *Pilgrim Street, Ludgate Hill, London, E.C.*

Arithmetic.

1. ANXIOUS.—The Government offers to holders of 3% consols, £108 of 2½% stock, or £102 of 2¾% stock, in exchange for every £100 consols. I hold £1500 in the 3% consols, and if I retain £300 of that stock, and convert £600 thereof into 2½% stock, and the remainder into the 2¾%, what will be the alteration in my income?

Income in 1st case = 3% on £1500
= £45;
,, 2nd ,, = 3% on £300 + 2½% on (£108 × 6) + 2¾% on (£102 × 6)
= £9 + 2½% on £648 + 2¾% on £612
= £9 + £16 4s. + £16 16s. 7½d.
= £42 os. 7½d.;
∴ Alteration in income = (£45 − £42 os. 7½d.) decrease
= £2 19s. 4½d. decrease.

2. MISTY.—A quantity of ore containing 23 per cent. of copper is bought at 9s. per cwt.; 95 per cent. of the copper is extracted at a cost of 2s. 10½d. per cwt. of ore; find the price per ton at which the copper must be sold, if a profit of 15 per cent. is to be made. (*Examination Paper*, 1884, *Stage I.*)

$$\text{Cost of } \left(\frac{\cancel{19}}{\cancel{20}\cancel{0}} \text{ of } \frac{23}{100}\right) \text{ cwt. of copper} = 9\text{s.} + 2\text{s. } 10\tfrac{1}{2}\text{d.},$$

$$\text{,, } \frac{437}{2000} \text{ cwt. ,, } = 11\text{s. } 10\tfrac{1}{2}\text{d.},$$

$$\therefore \text{Cost of 1 cwt. of copper} = 11\text{s. } 10\tfrac{1}{2}\text{d.} \times \frac{2000}{437}$$

$$= \left(\frac{\cancel{19}\cancel{8}}{\cancel{43}\cancel{8}} \times \frac{\cancel{20}\cancel{0}\cancel{0}}{\cancel{43}\cancel{7}}\right)£ \quad \begin{matrix}\cancel{19} & 125\\ \cancel{43}\cancel{8} & \cancel{20}\cancel{0}\cancel{0}\\ \cancel{87} & \cancel{437}\\ 2 & 23\end{matrix}$$

$$= \tfrac{250}{23}£;$$

$$\text{,, 1 ton ,, ,, } = \frac{125 \times \cancel{20}}{\cancel{23}}£ \quad \begin{matrix}10\cdot\\ \cancel{20}\\ \cancel{23}\end{matrix}$$

$$= 108\tfrac{10}{23}£;$$

$$\therefore \text{Selling price per ton} = \left(\frac{125\cancel{0}}{\cancel{23}} \times \frac{\cancel{19}\cancel{8}}{\cancel{20}\cancel{0}}\right)£ \quad \begin{matrix}\cancel{8}\\ \cancel{20}\end{matrix}$$

$$= £62\ 10\text{s.} \quad \text{Ans.}$$

3. BOBIE TOOKRE.—Divide 33 cwt. 2 qrs. 22 lbs. into three such parts that 6 times the first, 9 times the second, and 10 times the third may be equal amounts.

$$\tfrac{1}{6} + \tfrac{1}{9} + \tfrac{1}{10} = \frac{15+10+9}{90} = \tfrac{34}{90};$$

33 cwt. 2 qrs. 22 lbs. ÷ 34 = 3 qrs. 27 lbs.;
∴ First part = 3 qrs. 27 lbs. × 15
= 14 cwt. 3 qrs. 13 lbs.;
Second ,, = 3 qrs. 27 lbs. × 10
= 9 cwt. 3 qrs. 18 lbs.;
Third ,, = 3 qrs. 27 lbs. × 9
= 8 cwt. 3 qrs. 19 lbs.

4. TREONCHY.—A can copy 6 pages whilst B can copy 5; B copies 15 whilst C copies 12; and C copies 4 whilst D copies 3.

A, who can write 20 pages a day, receives a paper of 240 pages to copy, and after doing one-quarter of it, calls in B, C, and D to help him. When will the work be finished? (*Ricks.*)

D copies 3 pages whilst C copies 4,
∴ ,, 9 ,, ,, ,, 12;
B ,, 5 ,, A ,, ,, 6,
∴ ,, 15 ,, ,, ,, 18
∴ B can copy in a day 1½ of 20 pages
= ⅜ ,,
= 7½ pages
= 16¾ pages;
C ,, ,, 1½ of 20 pages
= ⅔ ,,
= 13⅓ pages;
D ,, ,, 1/15 of 20 pages
= 10 pages;
A can copy ¼ of the paper in (60 ÷ 20) days = 3 days;
All can finish it in {180 ÷ (20 + 16¾ + 13⅓ + 10)} days
= (180 ÷ 60) days
= 3 days;
∴ Time = 3 days + 3 days
= 6 days. Ans.

5. GRÆCA.—The discount on a certain sum due 9 months hence is £20, and the interest on the same sum for the same time is £20 15s. Find the sum and the rate of interest. (*Hughes'* Government Inspection Sums.')

The difference between the simple interest and the discount is the simple interest on the discount.

∴ Interest on the discount for 9 months = £20 15s. − £20
= 15s.;
,, ,, ,, a year = 15s. × 4/3
= £1;
Interest on £20 for a year = £1,
∴ ,, £100 ,, = £5;
∴ Rate per cent. = 5. Ans.

1/15 or 1/3 of £5 = £3⅓;

£	£	£	
3⅓	2/3	103⅓	Sum.
4	4	4	
13		415	
3		4	
		3 | 1660	

£553 6s. 8d. Ans.

6. ANNIE LINDSAY.—A sum is laid out in the 4 per cents., standing at 102½, and one-half year's dividend received upon it; the stock is then sold out at 105⅛, and the whole increase of capital, including the half-year's interest is £253 10s. Find the original sum.

Increase on an investment of £102½
= (£105⅛ − £102½) + ½ of £4
= £2⅛ + £2
= £4⅛;

£	£	£	
4⅛	253½	102½	Original sum.
8	2	4	
33	507	410	
	13		

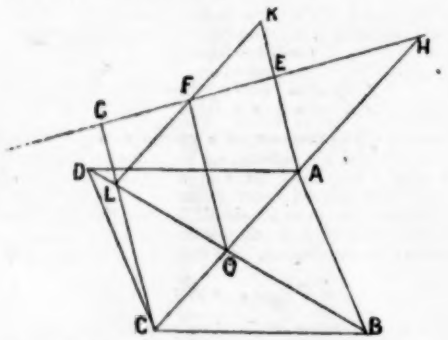
= £5330. Ans.

7. CYCLOPS.—A certain alloy consists of 19 parts by weight nickel, 17 lead, and 41 tin. The only nickel I can obtain is 10 lbs. of an alloy containing 11 parts of nickel to 7 parts tin and 5 lead. How much lead and tin must I add to make up the alloy I want? (*Merrifield's* 'Technical Arithmetic.')

Quantity of nickel in alloy $= \frac{11}{11+7+5}$ of 10 lbs.
$= \frac{1}{2}\frac{1}{3}$ of 10 lbs.
$= \frac{11}{23}$ lbs. ;
,, lead ,, $= \frac{5}{23}$ of 10 lbs.
$= \frac{5}{23}$ lbs. ;
,, tin ,, $= \frac{7}{23}$ of 10 lbs.
$= \frac{7}{23}$ lbs. ;
,, lead required $= \frac{5}{11}$ of $\frac{11}{23}$ lbs.
$= \frac{5}{23}$ lbs. ;
,, tin ,, $= \frac{7}{11}$ of $\frac{11}{23}$ lbs.
$= \frac{77}{437}$ lbs. ;
∴ Quantity of lead to be added $= \frac{187}{437}$ lbs. $- \frac{5}{23}$ lbs.
$= \frac{1870 - 950}{437}$ lbs.
$= \frac{920}{437}$ lbs.
$= \frac{80}{37}$ lbs.
$= 2\frac{6}{37}$ lbs. ;
,, tin ,, $= \frac{770}{437}$ lbs. $- \frac{7}{23}$ lbs.
$= \frac{4510 - 1330}{437}$ lbs.
$= \frac{3180}{437}$ lbs.
$= 7\frac{121}{437}$ lbs.

Geometry.

1. SECOND YEAR P.T.—If straight lines be drawn from the angles of any parallelogram perpendicular to any straight line, which is outside the parallelogram, the sum of those from one pair of opposite angles is equal to the sum of those from the other pair of opposite angles. (*Todhunter.*)



Let ABCD be a parallelogram, and let O be the intersection of the diagonals AC, BD.

The diagonals of a parallelogram bisect each other; therefore the diagonals AC, BD, are bisected at O.

Let AE, OF, CG, be the perpendiculars respectively from A, O, C, on the straight line outside the parallelogram.

Then the sum of the perpendiculars AE, CG, shall be double the perpendicular OF.

Let CA, GE, produced meet in H.

Through F draw KL parallel to AC, meeting AE produced at K, and CG at L.

Thus, KL = AC, KF = AO, and FL = OC. (I. 34)
But AO = OC;
∴ KF = FL.
In the triangles EFK, LFG,
∠ EFK = ∠ LFG, (I. 15)
∠ KEF = ∠ LGF, (I. 29)
And side KF = side FL;
Wherefore EK = LG. (I. 26)
∴ AE and CG together = AK and CL together
= twice OF. (I. 34)

Similarly it can be proved that the sum of the perpendiculars from B and D equal twice the perpendicular OF.

∴ The sum of the perpendiculars from A and C = the sum of the perpendiculars from B and D.—Q. E. D.

Mensuration.

1. G. F. A. BOLDMERE.—I put a stone into a cylindrical vessel, whose base is a circle of 14 inches diameter. I then cover the stone with water, and on removing the stone find that the water sinks $\frac{1}{4}$ of an inch. Determine the volume of the stone, expressing it in cubic inches. (*Cassell's* 'Saturday Journal.')

Volume of stone $= \{(14^2 \times \cdot7854) \times \frac{1}{4}\}$ cub. in.
$= (7^2 \times \cdot7854)$ cub. in.
$= (5\cdot4978 \times 7)$ cub. in.
$= 38\cdot4846$ cub. in.
$= 38\frac{1}{4}$ cub. in. nearly.

2. PENDA.—A room whose height is 11 ft., and length twice its breadth, takes 143 yds. of paper 2 ft. wide for its four walls. How much carpet will it require? (*Hiley.*)

Area of walls = 143 yds. × 2 ft.
= (429 × 2) sq. ft.
= 858 sq. ft. ;
∴ Perimeter of room = 858 sq. ft. ÷ 11 ft.
= 78 ft.
But, perimeter of room = (length + breadth) × 2 ;
∴ (Length in ft. + breadth in ft.) × 2 = 78 ft.
Twice breadth in ft. + breadth in ft. = 39 ft.
3 times breadth in ft. = 39 ft.
∴ Breadth = 13 ft.,
And Length = 26 ft.;
∴ Quantity of carpet = 26 ft. × 13 ft.
$= \frac{26 \times 13}{9}$ sq. yds.
$= 28\frac{8}{9}$ sq. yds.
$= 37\frac{8}{9}$ sq. yds. Ans.

Note.—Write to Messrs. Blackie and Son, Old Bailey, E.C., or Messrs. Philip and Son, Fleet Street, E.C.

3. SELINA.—How many rods of brickwork are there in a wall 77 ft. long, 16 ft. high, and 1 ft. $10\frac{1}{2}$ in. thick? (*Barnard Smith.*)

(A rod of brickwork = $272\frac{1}{4}$ sq. ft., and the work is supposed to be 14 in. thick.)

No. of rods of brickwork $= \{(77 \text{ ft.} \times 16 \text{ ft.}) \div 272\frac{1}{4} \text{ sq. ft.}\} \times \frac{1 \text{ ft. } 10\frac{1}{2} \text{ in.}}{14 \text{ in.}}$

$= \frac{\overset{7}{\cancel{77}} \times 16 \times 4}{\underset{99}{\cancel{108}}} \times \frac{22\frac{1}{2} \text{ in.}}{14 \text{ in.}}$

$= \frac{\overset{16}{\cancel{448}}}{\underset{99}{\cancel{99}}} \times \frac{\overset{5}{\cancel{45}}}{\underset{\cancel{28}}{\cancel{28}}}$

$= \frac{\overset{11}{\cancel{80}}}{\underset{11}{\cancel{11}}}$

$= 7\frac{3}{11}$. Ans.

Algebra.

1. SEBASTIAN.—A number of soldiers were drawn up in a solid column. If there had been 3 more ranks and 1 man less in each rank, the number of soldiers would have been 12 more; but if there had been 3 less ranks and 1 man more in each rank, the number of soldiers would have been 18 less. Find the number of soldiers in the column. (*Page's* 'Pupil Teachers' Course.')

Let x = No. of ranks,
And ,, y = ,, soldiers in each rank ;
Then xy = ,, ,, in column ;
∴ (1) $(x+3)(y-1) = xy + 12$
(2) $(x-3)(y+1) = xy - 18$
(1) $xy - x + 3y - 3 = xy + 12$
(2) $xy + x - 3y - 3 = xy - 18$
(1) $-x + 3y = 15$
(2) $x - 3y = -15$

As both these equations are the same, the question is indeterminate ;

$-x + 3y = 15$
$3y = 15 + x$
$\therefore y = 5 + \frac{x}{3}$.

If $x = 3$, $y = 6$;
$x = 6$, $y = 7$;
$x = 9$, $y = 8$;
$x = 12$, $y = 9$, etc.

∴ No. of soldiers in column = 18, or 42, or 72, or 108, etc.

Note.—The question is not complete. Similar sums from the same work were given in our last issue, and our issue for June, 1884.

2. HANNIBAL.—A constable in pursuit of a thief at a uniform pace, finds by inquiry that the thief is travelling $1\frac{1}{2}$ miles per hour quicker than himself; he therefore doubles his speed after the first 4 hours and takes the thief at the end of 6 hours and 20 minutes from the time of his starting. Given that the thief had a start of 1 hour, and never varied his speed, find the rates of travelling of the two parties, and the distance at which the capture took place. (*Wood.*)

Let x = Constable's rate per hour in miles at first,
Then, $x+1\frac{1}{2}$ = Thief's " " " throughout;

$$\therefore\ 4x+(2x\times 2\tfrac{1}{2})=(x+1\tfrac{1}{2})\times 7\tfrac{1}{3}$$
$$4x+\frac{14x}{3}=(x+\tfrac{3}{2})\times\tfrac{22}{3}$$
$$\frac{26x}{3}=\frac{22x}{3}+11$$
$$\frac{26x}{3}-\frac{22x}{3}=11$$
$$\frac{4x}{3}=11$$
$$\therefore\ x=11\times\tfrac{3}{4}$$
$$=\tfrac{33}{4}$$
$$=8\tfrac{1}{4}.$$

$\therefore$ Constable's rate at first $=8\frac{1}{4}$ miles per hour;
Thief's rate throughout $=9\frac{3}{4}$ " " " ";

$$\text{Distance}=9\tfrac{3}{4}\text{ miles}\times 7\tfrac{1}{3}=\left(\frac{\overset{13}{\cancel{39}}}{\underset{2}{\cancel{4}}}\times\frac{\overset{11}{\cancel{22}}}{\cancel{3}}\right)\text{ miles}$$
$$=\underline{1\tfrac{1}{2}^{3}\text{ miles}=71\tfrac{1}{2}\text{ miles.}}\quad\text{Ans.}$$

3. CYMRO TWP.—Solve:—

$$\left.\begin{aligned}a(x+y)+b(x-y)&=1\\a(x-y)+b(x+y)&=1\end{aligned}\right\}\ (\textit{Todhunter's}\text{ 'Algebra for Beginners.')}$$

$$\left.\begin{aligned}(1)\ a(x+y)+b(x-y)&=1\\(2)\ a(x-y)+b(x+y)&=1\end{aligned}\right\}$$
$$\left.\begin{aligned}(1)\ ax+ay+bx-by&=1\\(2)\ ax-ay+bx+by&=1\end{aligned}\right\}$$
Adding: $2ax+2bx=2$
$$ax+bx=1$$
$$(a+b)x=1$$
$$\therefore\ x=\underline{\frac{1}{a+b}.}$$
Subtracting: $2ay-2by=0$
$$2(a-b)y=0$$
$$\therefore\ \underline{y=0.}$$

4. C. F. C.—Solve:—

$$\frac{\sqrt{a^2-x^2}-\sqrt{b^2+x^2}}{\sqrt{a^2-x^2}+\sqrt{b^2+x^2}}=\frac{c}{d}.\quad(\textit{Colenso.})$$
$$\frac{\sqrt{a^2-x^2}-\sqrt{b^2+x^2}}{\sqrt{a^2-x^2}+\sqrt{b^2+x^2}}=\frac{c}{d}.$$
$$\left.\begin{aligned}&\text{Numerator}+\text{Denominator}\\&\text{Numerator}-\text{Denominator}\end{aligned}\right\}$$
$$\frac{2\sqrt{a^2-x^2}}{-2\sqrt{b^2+x^2}}=\frac{c+d}{c-d}$$
$$\frac{\sqrt{a^2-x^2}}{-\sqrt{b^2+x^2}}=\frac{c+d}{c-d}$$
Squaring: $\dfrac{a^2-x^2}{b^2+x^2}=\dfrac{(c+d)^2}{(c-d)^2}$
$$(a^2-x^2)(c-d)^2=(b^2+x^2)(c+d)^2$$
$$a^2(c-d)^2-b^2(c+d)^2=x^2(c+d)^2+x^2(c-d)^2$$
$$=2(c^2+d^2)x^2$$
$$x^2=\frac{a^2(c-d)^2-b^2(c+d)^2}{2(c^2+d^2)}$$
$$\therefore\ x=\pm\sqrt{\frac{a^2(c-d)^2-b^2(c+d)^2}{2(c^2+d^2)}}$$

5. NOBODY.—A, B, and C sit down to play; in the first game, A loses to B and C as much as each of them has; in the second, B loses similarly to A and C; and in the third, C loses similarly to A and B; and now they have each 24 shillings. What had they each at first? (*Colenso.*)

Let x, y, and z = original amounts of A, B, and C respectively, in shillings.

$$\left.\begin{aligned}\text{Then, }(1)\ 4(x-y-z)&=24\\(2)\ 2\{2y-(x-y-z)-2z\}&=24\\(3)\ 4z-2\{x-y-z)-\{2y-(x-y-z)-2z\}&=24\end{aligned}\right\}$$
$$\left.\begin{aligned}(1)\ x-y-2&=6\\(2)\ 2y-(x-y-z)-2z&=12\end{aligned}\right\}$$
$$(3)\ 4z-2\times 6-12=24$$
$$4z-12-12=24$$
$$4z-24=24$$
$$4z=48$$
$$\therefore\ \underline{z=12.}$$
$$(2)\ 2y-6-2\times 12=12$$
$$2y-6-24=12$$
$$2y=12+30$$
$$2y=42$$
$$\therefore\ \underline{y=21.}$$
$$(1)\ x-21-12=6$$
$$x=6+33$$
$$\therefore\ \underline{x=39.}$$

$\therefore$ A had 39s., B 21s., and C 12s.

6. HAZY.—Solve:—

$$\left.\begin{aligned}4x^2+y^2+2(2x+y)&=6\\4xy(xy+1)&=3\end{aligned}\right\}\ (\textit{Todhunter's}\text{ 'Algebra for Beginners.')}$$
$$\left.\begin{aligned}(1)\ 4x^2+y^2+2(2x+y)&=6\\(2)\ 4xy(xy+1)&=3\end{aligned}\right\}$$
$$(1)\ (4x^2+4xy+y^2)+2(2x+y)=6+4xy$$
$$(2x+y)^2+2(2x+y)=6+4xy$$
$$(2x+y)^2+2(2x+y)+1=7+4xy$$
$$(2x+y)+1=\pm\sqrt{7+4xy}$$
$$\therefore 2x+y=\underline{-1\pm\sqrt{7+4xy}.}$$
$$(2)\ xy(xy+1)=\tfrac{3}{4}$$
$$(xy)^2+xy+(\tfrac{1}{2})^2=\tfrac{3}{4}+\tfrac{1}{4}$$
$$=1$$
$$xy+\tfrac{1}{2}=\pm 1$$
$$xy=\pm 1-\tfrac{1}{2}$$
$$\therefore\ xy=\underline{\pm 1,\text{ or }-\tfrac{3}{4}.}$$
$$\therefore\ 2x+y=-1\pm\sqrt{7+(\tfrac{1}{2}\times 4)};\quad\text{or }-1\pm\sqrt{7+(-\tfrac{3}{4}\times 4)}$$
$$=-1\pm\sqrt{7+2};\quad\text{or }-1\pm\sqrt{7-6}$$
$$=-1\pm\sqrt{9};\quad\text{or }-1\pm\sqrt{1}$$
$$=-1\pm 3;\quad\text{or }-1\pm 1$$
$$=\underline{2,\text{ or }-4;\quad\text{or }0,\text{ or }-2.}$$
$$xy=\tfrac{1}{4},\text{ or }-\tfrac{3}{4}$$
$$\therefore\ y=\underline{\frac{1}{2x},\text{ or }\frac{3}{2x}.}$$
$$(1)\ \therefore\ 2x+\frac{1}{2x}=2,\text{ or }-4$$
$$4x^2+1=4x,\text{ or }-8x$$
$$(a)\ 4x^2-4x+1=0$$
$$(2x-1)^2=0$$
$$2x-1=0$$
$$2x=1$$
$$\therefore\ x=\tfrac{1}{2}.$$
$$y=\frac{1}{2x}=\frac{1}{\frac{1}{2}\times 2}=\underline{1.}$$
$$(b)\ 4x^2+1=-8x$$
$$4x^2+8x=-1$$
$$x^2+2x=-\tfrac{1}{4}$$
$$x^2+2x+1=1-\tfrac{1}{4}$$
$$=\tfrac{3}{4}$$
$$x+1=\frac{\pm\sqrt{3}}{2}$$
$$x=-1\pm\frac{\sqrt{3}}{2}$$
$$\therefore\ x=\frac{-2\pm\sqrt{3}}{2}$$
$$y=\frac{1}{2x}=\frac{1}{\frac{-2\pm\sqrt{3}}{2}\times 2}=\frac{1}{-2\pm\sqrt{3}}$$
$$\frac{-2\mp\sqrt{3}}{(-2\pm\sqrt{3})(-2\mp\sqrt{3})}=\frac{-2\mp\sqrt{3}}{4-3}=\underline{-2\mp\sqrt{3}.}$$
$$(2)\ 2x+y=0,\text{ or }-2$$
$$2x-\frac{3}{2x}=0,\text{ or }-2$$

7. CYCLOPS.—A certain alloy consists of 19 parts by weight nickel, 17 lead, and 41 tin. The only nickel I can obtain is 10 lbs. of an alloy containing 11 parts of nickel to 7 parts tin and 5 lead. How much lead and tin must I add to make up the alloy I want? (*Merrifield's* 'Technical Arithmetic.')

Quantity of nickel in alloy $= \frac{11}{11+7+5}$ of 10 lbs.
$= \frac{1}{2}$ of 10 lbs.
$= \frac{10}{2}$ lbs.;
„ lead „ $= \frac{5}{23}$ of 10 lbs.
$= \frac{50}{23}$ lbs.;
„ tin „ $= \frac{7}{23}$ of 10 lbs.
$= \frac{70}{23}$ lbs.;
„ lead required $= \frac{17}{19}$ of $\frac{190}{23}$ lbs.
$= \frac{1870}{437}$ lbs.;
„ tin „ $= \frac{41}{19}$ of $\frac{190}{23}$ lbs.
$= \frac{7790}{437}$ lbs.;
∴ Quantity of lead to be added $= \frac{1870}{437}$ lbs. $- \frac{50}{23}$ lbs.
$= \frac{1870 - 950}{437}$ lbs.
$= \frac{920}{437}$ lbs.
$= \frac{80}{19}$ lbs.
$= 2\frac{5}{19}$ lbs.;
„ tin „ $= \frac{7790}{437}$ lbs. $- \frac{70}{23}$ lbs.
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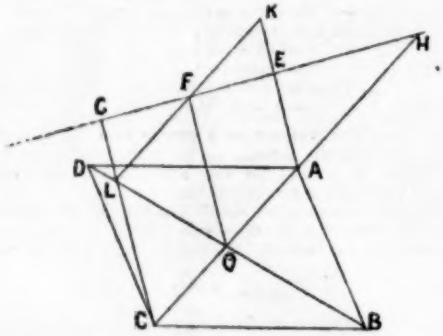
$= \frac{3180}{437}$ lbs.
$= 7\frac{131}{437}$ lbs.

Geometry.

1. SECOND YEAR P.T.—If straight lines be drawn from the angles of any parallelogram perpendicular to any straight line, which is outside the parallelogram, the sum of those from one pair of opposite angles is equal to the sum of those from the other pair of opposite angles. (*Todhunter.*)



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Then the sum of the perpendiculars AE, CG, shall be double the perpendicular OF.

Let CA, GE, produced meet in H.

Through F draw KL parallel to AC, meeting AE produced at K, and CG at L.

Thus, KL = AC, KF = AO, and FL = OC. (I. 34)

But AO = OC;

∴ KF = FL.

In the triangles EFK, LFG,

∠ EFK = ∠ LFG, (I. 15)

∠ KEF = ∠ LGF, (I. 29)

And side KF = side FL;

Wherefore EK = LG. (I. 26)

∴ AE and CG together = AK and CL together
= twice OF. (I. 34)

Similarly it can be proved that the sum of the perpendiculars from B and D equal twice the perpendicular OF.

∴ The sum of the perpendiculars from A and C = the sum of the perpendiculars from B and D.—Q. E. D.

Mensuration.

1. G. F. A. BOLDMERE.—I put a stone into a cylindrical vessel, whose base is a circle of 14 inches diameter. I then cover the stone with water, and on removing the stone find that the water sinks $\frac{1}{4}$ of an inch. Determine the volume of the stone, expressing it in cubic inches. (*Cassell's* 'Saturday Journal.')

Volume of stone $= \{(14^2 \times \cdot7854) \times \frac{1}{4}\}$ cub. in.
$= (7^2 \times \cdot7854)$ cub. in.
$= (5\cdot4978 \times 7)$ cub. in.
$= 38\cdot4846$ cub. in.
$= 38\frac{1}{2}$ cub. in. nearly.

2. PENDA.—A room whose height is 11 ft., and length twice its breadth, takes 143 yds. of paper 2 ft. wide for its four walls. How much carpet will it require? (*Hiley.*)

Area of walls = 143 yds. × 2 ft.
= (429 × 2) sq. ft.
= 858 sq. ft.;
∴ Perimeter of room = 858 sq. ft. ÷ 11 ft.
= 78 ft.
But, perimeter of room = (length + breadth) × 2;
∴ (Length in ft. + breadth in ft.) × 2 = 78 ft.
Twice breadth in ft. + breadth in ft. = 39 ft.
3 times breadth in ft. = 39 ft.
∴ Breadth = 13 ft.,
And Length = 26 ft.;
∴ Quantity of carpet = 26 ft. × 13 ft.
$= \frac{26 \times 13}{9}$ sq. yds.
$= \frac{338}{9}$ sq. yds.
$= 37\frac{5}{9}$ sq. yds. Ans.

Note.—Write to Messrs. Blackie and Son, Old Bailey, E.C., or Messrs. Philip and Son, Fleet Street, E.C.

3. SELINA.—How many rods of brickwork are there in a wall 77 ft. long, 16 ft. high, and 1 ft. 10½ in. thick? (*Barnard Smith.*)

(A rod of brickwork = 272¼ sq. ft., and the work is supposed to be 14 in. thick.)

No. of rods of brickwork $= \{(77 \text{ ft.} \times 16 \text{ ft.}) \div 272\frac{1}{4} \text{ sq. ft.}\} \times \frac{1 \text{ ft. } 10\frac{1}{2} \text{ in.}}{14 \text{ in.}}$

$= \frac{\cancel{77} \times 16 \times \cancel{4}}{\cancel{1089}_{\cancel{99}}} \times \frac{22\frac{1}{2} \text{ in.}}{14 \text{ in.}}$

$= \frac{\cancel{416}}{\cancel{99}} \times \frac{\cancel{45}}{\cancel{28}}$

$= \frac{80}{11}$

$= 7\frac{3}{11}$. Ans.

Algebra.

1. SEBASTIAN.—A number of soldiers were drawn up in a solid column. If there had been 3 more ranks and 1 man less in each rank, the number of soldiers would have been 12 more; but if there had been 3 less ranks and 1 man more in each rank, the number of soldiers would have been 18 less. Find the number of soldiers in the column. (*Page's* 'Pupil Teachers' Course.')

Let x = No. of ranks,
And „ y = „ soldiers in each rank;
Then xy = „ „ in column;

∴ (1) $(x+3)(y-1) = xy+12$
(2) $(x-3)(y+1) = xy-18$
(1) $xy - x + 3y - 3 = xy + 12$
(2) $xy + x - 3y - 3 = xy - 18$
(1) $-x + 3y = 15$
(2) $x - 3y = -15$

As both these equations are the same, the question is indeterminate;

$-x + 3y = 15$
$3y = 15 + x$
$\therefore y = 5 + \frac{x}{3}$.

If $x = 3$, $y = 6$;
$x = 6$, $y = 7$;
$x = 9$, $y = 8$;
$x = 12$, $y = 9$, etc.

∴ No. of soldiers in column = 18, or 42, or 72, or 108, etc.

Note.—The question is not complete. Similar sums from the same work were given in our last issue, and our issue for June, 1884.

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Let x = Constable's rate per hour in miles at first,
Then, $x+1\frac{1}{2}$ = Thief's " " " throughout;

$$\therefore\ 4x+(2x\times 2\tfrac{1}{2})=(x+1\tfrac{1}{2})\times 7\tfrac{1}{3}$$
$$4x+\frac{14x}{3}=(x+\tfrac{3}{2})\times\tfrac{22}{3}$$
$$\frac{26x}{3}=\frac{22x}{3}+11$$
$$\frac{26x}{3}-\frac{22x}{3}=11$$
$$\frac{4x}{3}=11$$
$$\therefore\ x=11\times\tfrac{3}{4}$$
$$=\tfrac{33}{4}.$$
$$=8\tfrac{1}{4}.$$

$\therefore$ Constable's rate at first $=8\frac{1}{4}$ miles per hour;
Thief's rate throughout $=9\frac{3}{4}$ " " " ;

$$\text{Distance}=9\tfrac{3}{4}\text{ miles}\times 7\tfrac{1}{3}=\left(\frac{39}{4}\times\frac{22}{3}\right)\text{ miles}$$
$$=\frac{143}{2}\text{ miles}=71\tfrac{1}{2}\text{ miles.}\quad\text{Ans.}$$

3. CYMRO TWP.—Solve:—

$$\left.\begin{aligned}a(x+y)+b(x-y)&=1\\ a(x-y)+b(x+y)&=1\end{aligned}\right\}\ (\textit{Todhunter's}\text{ 'Algebra for Beginners.')}$$

$$\left.\begin{aligned}(1)\ a(x+y)+b(x-y)&=1\\ (2)\ a(x-y)+b(x+y)&=1\end{aligned}\right\}$$
$$\left.\begin{aligned}(1)\ ax+ay+bx-by&=1\\ (2)\ ax-ay+bx+by&=1\end{aligned}\right\}$$
Adding, $2ax+2bx=2$
$$ax+bx=1$$
$$(a+b)x=1$$
$$\therefore\ x=\frac{1}{a+b}.$$
Subtracting, $2ay-2by=0$
$$2(a-b)y=0$$
$$\therefore\ y=0.$$

4. C. F. C.—Solve:—

$$\frac{\sqrt{a^2-x^2}-\sqrt{b^2+x^2}}{\sqrt{a^2-x^2}+\sqrt{b^2+x^2}}=\frac{c}{a}.\quad(\textit{Colenso.})$$
$$\frac{\sqrt{a^2-x^2}-\sqrt{b^2+x^2}}{\sqrt{a^2-x^2}+\sqrt{b^2+x^2}}=\frac{c}{d}.$$
$$\left.\begin{aligned}&\text{Numerator}+\text{Denominator}\\ &\text{Numerator}-\text{Denominator}\end{aligned}\right\}$$
$$\frac{2\sqrt{a^2-x^2}}{-2\sqrt{b^2+x^2}}=\frac{c+d}{c-d}$$
$$\frac{\sqrt{a^2-x^2}}{-\sqrt{b^2+x^2}}=\frac{c+d}{c-d}$$
Squaring, $\frac{a^2-x^2}{b^2+x^2}=\frac{(c+d)^2}{(c-d)^2}$
$$(a^2-x^2)(c-d)^2=(b^2+x^2)(c+d)^2$$
$$a^2(c-d)^2-b^2(c+d)^2=x^2(c+d)^2+x^2(c-d)^2$$
$$=2(c^2+d^2)x^2$$
$$x^2=\frac{a^2(c-d)^2-b^2(c+d)^2}{2(c^2+d^2)}$$
$$\therefore\ x=\pm\sqrt{\frac{a^2(c-d)^2-b^2(c+d)^2}{2(c^2+d^2)}}$$

5. NOBODY.—A, B, and C sit down to play; in the first game, A loses to B and C as much as each of them has; in the second, B loses similarly to A and C; and in the third, C loses similarly to A and B; and now they have each 24 shillings. What had they each at first? (*Colenso.*)

Let x, y, and z = original amounts of A, B, and C respectively, in shillings.

$$\left.\begin{aligned}\text{Then, }(1)\ 4(x-y-z)&=24\\ (2)\ 2\{2y-(x-y-z)-2z\}&=24\\ (3)\ 4z-2(x-y-z)-\{2y-(x-y-z)-2z\}&=24\end{aligned}\right\}$$
$$\left.\begin{aligned}(1)\ x-y-2&=6\\ (2)\ 2y-(x-y-z)-2z&=12\\ (3)\ 4z-2\times 6-12&=24\end{aligned}\right\}$$
$$4z-12-12=24$$
$$4z-24=24$$
$$4z=48$$
$$\therefore\ z=12.$$
$$(2)\ 2y-6-2\times 12=12$$
$$2y-6-24=12$$
$$2y=12+30$$
$$2y=42$$
$$\therefore\ y=21.$$
$$(1)\ x-21-12=6$$
$$x=6+33$$
$$\therefore\ x=39.$$
$\therefore$ A had 39s., B 21s., and C 12s.

6. HAZY.—Solve:—

$$\left.\begin{aligned}4x^2+y^2+2(2x+y)&=6\\ 4xy(xy+1)&=3\end{aligned}\right\}\ (\textit{Todhunter's}\text{ 'Algebra for Beginners.')}$$
$$\left.\begin{aligned}(1)\ 4x^2+y^2+2(2x+y)&=6\\ (2)\ 4xy(xy+1)&=3\end{aligned}\right\}$$
$$(1)\ (4x^2+4xy+y^2)+2(2x+y)=6+4xy$$
$$(2x+y)^2+2(2x+y)=6+4xy$$
$$(2x+y)^2+2(2x+y)+1=7+4xy$$
$$(2x+y)+1=\pm\sqrt{7+4xy}$$
$$\therefore 2x+y=-1\pm\sqrt{7+4xy}.$$
$$(2)\ xy(xy+1)=\tfrac{3}{4}$$
$$(xy)^2+xy+(\tfrac{1}{2})^2=\tfrac{3}{4}+\tfrac{1}{4}$$
$$=1$$
$$xy+\tfrac{1}{2}=\pm 1$$
$$xy=\pm 1-\tfrac{1}{2}$$
$$\therefore\ xy=\pm 1,\text{ or }-\tfrac{3}{2}.$$

$$\therefore\ 2x+y=-1\pm\sqrt{7+(\tfrac{1}{2}\times 4)};\quad\text{or }-1\pm\sqrt{7+(-\tfrac{3}{2}\times 4)}$$
$$=-1\pm\sqrt{7+2};\quad\text{or }-1\pm\sqrt{7-6}$$
$$=-1\pm\sqrt{9};\quad\text{or }-1\pm\sqrt{1}$$
$$=-1\pm 3;\quad\text{or }-1\pm 1$$
$$=2,\text{ or }-4;\quad\text{or }0,\text{ or }-2.$$
$$xy=\tfrac{1}{2},\text{ or }-\tfrac{3}{2}$$
$$\therefore\ y=\frac{1}{2x},\text{ or }\frac{3}{2x}$$

$$(1)\ \therefore\ 2x+\frac{1}{2x}=2,\text{ or }-4$$
$$4x^2+1=4x,\text{ or }-8x$$
$$(a)\ 4x^2-4x+1=0$$
$$(2x-1)^2=0$$
$$2x-1=0$$
$$2x=1$$
$$\therefore\ x=\tfrac{1}{2}.$$
$$y=\frac{1}{2x}=\frac{1}{\frac{1}{2}\times 2}=1.$$
$$(b)\quad 4x^2+1=-8x$$
$$4x^2+8x=-1$$
$$x^2+2x=-\tfrac{1}{4}$$
$$x^2+2x+1=1-\tfrac{1}{4}$$
$$=\tfrac{3}{4}$$
$$x+1=\frac{\pm\sqrt{3}}{2}$$
$$x=-1\pm\frac{\sqrt{3}}{2}$$
$$\therefore\ x=\frac{-2\pm\sqrt{3}}{2}$$
$$y=\frac{1}{2x}=\frac{1}{\frac{-2\pm\sqrt{3}}{2}\times 2}=\frac{1}{-2\pm\sqrt{3}}$$
$$\frac{-2\mp\sqrt{3}}{(-2\pm\sqrt{3})(-2\mp\sqrt{3})}=\frac{-2\mp\sqrt{3}}{4-3}=-2\mp\sqrt{3}.$$
$$(2)\quad 2x+y=0,\text{ or }-2$$
$$2x-\frac{3}{2x}=0,\text{ or }-2$$

(*a*) $2x=\frac{3}{2x}$

$4x^2=3$

$x^2=\frac{3}{4}$

$\therefore\ x=\frac{\pm\sqrt{3}}{2}$

$$y=-\frac{3}{2x}=-\frac{3}{\frac{\pm\sqrt{3}}{2}\times 2}=\frac{-3}{\pm\sqrt{3}}=\underline{\mp\sqrt{3}}.$$

(*b*) $2x-\frac{3}{2x}=-2$

$4x^2-3=-4x$

$4x^2+4x=3$

$x^2+x=\frac{3}{4}$

$x^2+x+(\frac{1}{2})^2=\frac{3}{4}+\frac{1}{4}$

$=1$

$x+\frac{1}{2}=\pm 1$

$x=\pm 1-\frac{1}{2}$

$\therefore\ x=\frac{1}{2}$, or $-\frac{3}{2}$.

$$\left.\begin{aligned} y=-\frac{3}{2x}=\frac{-3}{\frac{1}{2}\times 2}=-3, \\ \text{or } -\frac{3}{-\frac{3}{2}\times 2}=\frac{-3}{-3}=1. \end{aligned}\right\}$$

Note.—The above are the answers given in the book.

General.

1. ARTAXERXES.—You will find the solution of your query in our issue for April, 1884.

2. PENSEROSO.—The solution of your query appeared in our issue for June, 1884.

3. BOY'S OWN.—Your query was solved in our issue for January, 1885.

4. T. F. H.—The solution of your query appeared in our issue for May, 1882.

5. EX-P. T.—You will find the solution of your query in our issue for June, 1882.

6. X.—Your methods of working Nos. 5 and 8 are good, but we cannot say the same of No. 26. Your method of working this question is very complicated and involves large fractions, whereas by taking a sum on supposition, the solution is considerably simplified.

7. C. E. WALLIS.—As the information you ask for is known to every one in the profession, you had better consult the nearest certificated teacher.

8. ROGO.—Any subscriber to THE PRACTICAL TEACHER having Vol. I. (March, 1881, to February, 1882), bound or unbound, and in good condition, to dispose of, please address 'J. R. A., Schoolmaster, Wappenham, Towcester.'—N.B. Please state price.

9. W. PRITCHARD.—If you will send your query we shall have pleasure in answering it.

10. A. P. RHYS.—(1) Two sciences and two languages. (2) and (3), no.

11. FORMULÆ.—Yes, at any Training College, by early application to the Principal; Saltley, Birmingham, is your nearest college.

12. J. E. T. SMITH.—Gladman's 'School Method' has a chapter which would serve your purpose. There is no book on the subject.

13. A. W. M. (Sussex).—The following list of books is given for certificate, 2nd year:—

School Management...	The National Society's 'Complete Manual.'
Geography...	Hewitt's 'Colonies' and Mackay's 'General Geography.'
English Literature ...	'The Tempest' (Clarendon Press Series).
History	Justin McCarthy's 'History of Our Own Times' (abridged); 'Modern England' (Macmillan).
Algebra	Todhunter's large book.
Arithmetic...	Mansford's (Hughes).
Mensuration	Todhunter.
Euclid	Todhunter.
Political Economy ...	Mrs. Fawcett's 'Lessons.'
Language	*Latin:* Merryweather's 'Cæsar,' Books I.—III. (Rivington); also White's Grammar-School Text 'Cæsar,' Book III. *French:* Third Year's Course (Macmillan).
Music	Curwen's 'Construction Exercises,' Part B.
Physiography	Huxley's and Findlater's, Parts I. and II.
Agriculture	Tanner's (Macmillan's).

Handwriting: The large-hand is twice the size required, and is worth 55°/₀; half-text, 65°/₀.

14. J. C. MULRENAN.—The large-hand, see A. W. M.; (1) =60°/₀; (2) 80°/₀; (3) 75°/₀.

15. MUTATO NOMINE.—(*a*) Yes. (*b*) The marks obtainable are not published, nor is the number sufficient to obtain a first-class known. (*c*) The possession of one language, a science, and D, together with fair average attainment in the other subjects, will gain a first; without these extras, excellency in the other subjects is necessary in order to get within the first 300.

16. NORNA.—(1) Avoid the angular style. (2) Study Mulhäuser's system. (3) Good; keep to this style.

17. ERIN.—Study Curwen's 'Construction Exercises,' Part B.; obtain help if possible, especially in the science.

18. G. F. P.—Too upright. *Practical* is misspelled. Make your down-strokes even in thickness.

19. C. WILLIAMS.—Good in both cases.

20. MARCH.—(1) Thanks for the hint. (2) See answer to 'A. W. M. (Sussex)'. (4) Large-hand, 50°/₀; small-hand, 80°/₀.

21. ASSISTANT.—(*a*) Either method. (*b*) Medium points.

22. SOMAT.—Though very rare, septuple time may be used. This is an example of $\frac{7}{4}$ time.

23. TRENTE-ET-UN.—(*a*) Fair; practise from good copies every day. (*b*) 'First and Second Years' French Course' (Macmillan).

24. DONALD LOCKE.—75°/₀. Read 'Cæsar.' See 'Mutato Nomine.'

25. TABLE.—(*a*) Generally half-fee, by arrangement with the Principal. (*b*) We expect the certificate will be endorsed by the department.

26. CONSTANT READER.—No book so good as the one published in the Clarendon Press Series.

27. IDLER.—Parsing should deal with words individually, but when together they convey a special meaning which, taken separately they do not convey, parse them collectively, *e.g.*, 'in as much as,' subordinate conjunction of reason.

28. CERTIFICATE.—(1) Domestic Economy, Tegetmier's 'Domestic Economy; Music, see 'A. W. M.'; History, Green's is the best for your purpose; take to the accession of Queen Victoria. (2) 75°/₀.

29. ZANONI.—The answer is found in Newton's 'Principia,' Sections 1, 2, 3; our advice is, send the question to the Vice-President.

30. EXCELSIOR.—Write to Longmans. They will send you copies.

31. IGNORAMUS.—Ed. I. See page 75, Smith's smaller 'History of England.'

32. AGNES.—G. W. R.: Small-hand, 80°/₀; large, 55°/₀. The strokes are irregular, and shapes very defective. J. R.: Small-hand, 70°/₀; large, 55°/₀. Agnes: Small-hand, 70°/₀; large, 70°/₀.

33. WHY.—What is the meaning of *potential*? It means *expressing power*. Now, does *must* express power? Does *should* express power? It is evident, then, that the term is a bad one, applying to only a very few of the auxiliaries usually called auxiliaries of the potential mood. 'If I *can* go' is rightly said to be in the *potential mood*. Then 'I *must* go' ought to be in the compulsory mood, 'I ought to go' in the obligatory mood, and so on. Further, there is no need of this mood, for all verbs described as being of the potential mood may be placed under either the indicative or the subjunctive, *e.g.*, 'I can go'='I am able to go,' *i.e.*, it states a fact, and, therefore, is indicative. 'I wished that the mountains *might fall* on me.' Here *might* expresses uncertainty, and is an auxiliary, the sign of subjunctive mood.

34. SOPHIE.—No syllabus is published. See Code, 'Art. 47,' and read the whole of Schedule V. (New Code).

FRENCH PARSING.—We are indebted to a correspondent for having sent us the following with regard to 'My Scholarship' answers:—'*Du* is not a preposition, but a contracted article, which should be parsed as *de* and *le*: *De*, preposition governing *roi*; *le*, article, masc., sing., because agreeing with *roi*. *Obtint* is not a past participle, but should be parsed as transitive verb, indic., preterite, sing., 3rd, agreeing with *Colomb*, mentioned above.—A. M.'

35. MAGISTER.—See our issues for November, 1884, and January, 1885.

36. J. E. (Abergavenny).—(1) Rules for finding principal, rate per cent., and time in simple interest appeared in our

issue for August, 1884. (2) Cornwell's 'Geography.' (3) 'Royal History of England.'

37. J. K.—You will find the solution of your query in our issue for April, 1882.

38. GORILLA.—(1) The *third* method is the best. The second number is 20 more than the third, and the first is 57 more than the third; therefore the first and second numbers together are 77 more than twice the third; consequently third number = ⅓ of (4607 − 77). (2) Perhaps 90 per cent. The letter *s* and the capitals might be improved.

39. PERPLEXED.—The time is calculated the *same* way in both cases. Thus: (1) No. of days, from March 1st to January 10th. (2) No. of days from May 5th to October 27th.

	Days		Days
(1) March	30	(2) May	26
April	30	June	30
May	31	July	31
June	30	Aug.	31
July	31	Sept.	30
Aug.	31	Oct.	27
Sept.	30		175
Oct.	31		
Nov.	30		
Dec.	31		
Jan.	10		
	315		

—o—

ANSWERS TO ARITHMETICAL QUESTIONS IN 'THE SCHOLAR' FOR MARCH, 1885.

STANDARD III.

A. 1. 7682+202.
2. 904+3126.
3. 7210+82.
B. 1. 694+1821.
2. 1006+932.
3. 21,582+108.
C. 1. £100,441 5s. 1d.
2. £22,555 1s. 11⅔d.
3. £26,838 0s. 1d.
D. 1. £888 19s. 8¾d.
2. £983 0s. 3½d.
3. £10 0s. 5½d.
E. 1. £22 5s. 0½d.
2. 5s. 6d.
3. £82 2s. 2½d.

STANDARD IV.

A. 1. £76 10s. 9¾d. + 576.
2. 8,425,440 min.
3. 28,160 steps.
B. 1. 1 ton 4 cwts. 20 lbs. 13 oz. 11 drs.
2. 60,894 in.
3. £61 11s. 7d.
C. 1. 8 mls. 2 fur. 33 po. 2½ yds. 3 in.
2. 14,912,512 drams.
3. 1s. 11½d.
D. 1. 167,616 cub. in.
2. £70 2s. 8½d.
3. 24½ yds.
E. 1. 46 ac. 32 po.
2. 5170 threepences.
3. 98 parcels.

STANDARD V.

A. 1. 7s. 0¾d.
2. £4 1s. 4½d.
3. Total £485 16s. 3d.
B. 1. £90 18s. 2½d.
2. 1 hr. 47 min.
3. Total £95 1s. 1½d.
C. 1. £2 4s. 10d.
2. £472 14s. 1d.
3. Total £15 18s. 8¾d.
D. 1. £875 14s. 0d.
2. 3 ac. 1 ro. 30 po. + 274.
3. Total £46 15s. 1½d.
E. 1. 1 ml. 335 yds. + 5.
2. £183 9s. 6½d.
3. Total £75 13s. 4d.

STANDARD VI.

A. 1. £50.
2. 1$\frac{1}{11}$.
3. ·432106.
B. 1. £4 0s. 7½d.
2. 15 lb. 12 oz.
3. 2⅔.
C. 1. 1 ton 19 cwt. 42 lbs.
2. £13 7s. 9d.
3. 2⅞.
D. 1. 12 weeks.
2. 9s. 10½¾d.
3. 68·3171506849⅓.
E. 1. 91⅔ days.
2. 5$\frac{7}{11}$d.
3. ·084214.....

STANDARD VII.

A. 1. 16⅔.
2. £1882 7s. 0$\frac{1}{7}$d.
3. 4$\frac{1}{17}$ days.
B. 1. 4 per cent.
2. £229 8s. 2$\frac{1}{11}$d.
3. 10 per cent.
C. 1. £63.
2. 16 per cent.
3. 5½ years.
D. 1. (*a*) 15s.; (*b*) 15s. 9d.
2. £2000.
3. 45 passed in reading.
42 „ „ writing.
37 „ „ arith.

How to Teach History.

BY ISABELLA LANDALE.

SUMMARY.

INTRODUCTION.

Ends to be Aimed at.—Method of Attaining these Ends.—Causes of Deficient Method.—Mental Faculties Cultivated by a Study of History.

SECTION I.

Primary Ends to be Aimed at in Teaching History to Children.

CULTIVATION OF THE IMAGINATION BY THE CHARM OF HISTORICAL ASSOCIATIONS.

To Engage the Attention.—To Deepen the Impressions.

MORAL EFFECT OF THE HEROIC IN HISTORY.

Mode of Using this Moral Agent.—Choice of Subjects.—Style of Treatment.—Means of Effecting the desired End.

ACQUIREMENT OF HISTORICAL KNOWLEDGE, AND RESULTING MENTAL DISCIPLINE.

Where to Begin.—Methods of Teaching.—Forming the First Impression.—Fixing the Impressions.—Cultivation of the Memory by applying its Laws to the Retention of the Indispensable Parts of History.—Cultivation of the Judgment, and Deliberate Cultivation of 'Common Sense' (as the resultant of Forgotten Impressions).—Testing Results.—Standard of Attainment.—Change of Method for Advanced Pupils.

SECTION II.

Secondary Ends to be kept in view as the Ultimate Use of this Branch of Education in After-life.

A KNOWLEDGE OF HUMAN NATURE.

An Inductive Process.—Comparison of Similar Instances.

WIDTH OF VIEW AND INTERNATIONAL SYMPATHY.

Importance of the Study of History as a Means of Widening the Views of those whose Circumstances have a Narrowing Tendency.

BEARINGS OF HISTORY ON POLITICS.

Education of Public Opinion.—Bearings of Ancient History on Politics.—Prevention of Wars.

SECTION III.

FINAL RESULTS OF SUCH TRAINING AS A MEANS OF PERFECTING THE SCIENCE KNOWN AS

THE PHILOSOPHY OF HISTORY.

How is School Teaching connected with the Philosophy of History?—Sound Knowledge on the part of the Public a Safeguard against the False Generalisations of Brilliant but Untrustworthy Writers.—Co-operation of Average Minds necessary to provide Material for Leaders of Thought.

IT seems to us that the educational capabilities of history have not hitherto been sufficiently utilised. Its immense resources have been very slightly drawn upon for the purposes of moral education; its untold wealth of experience has rarely been used as a means of deliberately cultivating the judgment. And yet, perhaps, no school subject has wider possibilities. All are agreed that wisdom is gained much more from the experience of life than from school teaching; therefore it is that 'knowledge comes, but wisdom lingers.' However, is it not possible to hasten a little the lingering steps of wisdom by a systematic use of history as the experience of the ages?

Before attempting to suggest how this might be done, it would be well to ascertain definitely what ends we have in view in the school teaching of history, that we may understand clearly what is the goal we

intend to reach before we begin our preparations for the journey.

In self-culture, as well as in the education of others, failure results inevitably from the want of a clear idea of what we mean to do, and the consequent accidental and haphazard fashion in which the subjects of study are attacked.

What then do we place before us as our object in studying history? or, in other words, what is it fitted to teach? The lessons of history are so valuable, its field so vast and varied, that an attempt to answer this question fills us with a strong sense of the dignity and importance of our subject—a dignity and importance only rivalled by the vivid human interest attaching to it, which renders history so powerfully attractive to mankind. When the educational capabilities of history are seriously considered we find that they are much greater than is generally supposed. What school subject could offer to the teacher a wider field or a richer harvest than this? For the ends to be had in view in teaching history are—the elevation of the moral nature, the discipline of the mental faculties, the ultimate application of the knowledge acquired to the business of life.

In trying to discover the best means of attaining these ends, we shall divide our subject into three parts. We shall first speak of the primary ends to be aimed at in teaching children—

I.—*Cultivation of the Imagination by the Charm of Historical Association;*
Moral Effect of the Heroic in History;
Acquirement of Historical Knowledge, and resulting Mental Discipline.

We shall try to show how these ends affect the young student, and how they are most likely to be attained; and we shall devote most of our attention to this division of the subject, for it is in childhood that the method of teaching is of the greatest importance, as at that period more is done by the teacher, and less by the pupil, than is the case in after years. The third part of the first section will naturally receive the fullest treatment, as it is there that most technical difficulties occur.

As no system of teaching can be complete which does not keep constantly in view the final objects of study, we shall proceed, in the next place, to consider what these are; and to suggest how the historical knowledge, and consequent mental training, received at school, may be led to develop, in after years, into such results as—

II.—*Knowledge of Human Nature;*
Width of View, and International Sympathy;
Bearings of History on Politics.

Then, in the third place, rising from particulars to generalisations, we shall briefly consider history in its noblest aspect as a gradual unfolding of the methods of Divine government—a view of the subject which dwarfs all others, and which is most clearly displayed in

III.—*The Philosophy of History.*

Although the philosophy of the subject is still comparatively undeveloped, enough has already been done to make us feel that this alone is worthy to be our ultimate aim in the study of history.

We admit that the philosophy of history is not a suitable subject to be taught in schools, but it is desirable to lead up to it in teaching, that we may in some degree prepare the pupils for attacking it when their minds are sufficiently mature for such studies.

METHOD OF ATTAINING THESE ENDS.

Great, however, as is the importance of the ends we would set before the teacher, his chief concern is the method by which they are to be attained, for the mental discipline resulting from any study is in exact proportion to the excellence of the method by which it is taught. Now it is to be feared that hitherto (except in rare instances) the method of teaching history has not been such as to develop or strengthen the mental faculties, but that it has rather had an opposite tendency. This is to be accounted for by the fact, universally admitted, that the art of imparting this branch of knowledge is the least advanced in the whole range of methodology. Few efforts have been made to remedy this, and when an authority like Professor Bain openly proclaims that 'the teaching of history almost appears to defy method,'* it is apt to discourage attempts at finding one.

But if a subject is not capable of method it is simply not fit to be taught in schools at all; for no study has any educational value that does not yield mental discipline. It has been thought that the great value of the classics in developing and strengthening the mental faculties arises chiefly from the thoroughness and efficiency with which they are taught; for, the attention of teachers having been concentrated on classical teaching for centuries, great superiority of method has been attained. It is the mental training thus afforded which reaches the average schoolboy, who is far from being sufficiently advanced to be influenced by the beauties of style and vigour of thought which distinguish classical literature. If the skill displayed in the teaching of the classics could be transferred to the teaching of history, the effect would far transcend the meagre results now attained by our defective method. The benefits to be derived from a knowledge of history are so great, that to relinquish it as a subject of school study is out of the question; and, if the method is so faulty, there is the more need for every effort towards its improvement.

CAUSES OF DEFICIENT METHOD.

Many causes contribute to the deficiencies in historical teaching, the chief of these being the hopelessness arising from the vast extent of the subject, and the fact that too much is attempted; the accumulation of needless facts, and the absence of all attempt to make use of the facts acquired; overloading the memory with unnecessary dates, and neglecting to impress indelibly those which are indispensable; finally, the want of a good system of classification.

Feeling of Hopelessness.—The first of these—the feeling of hopelessness—is, perhaps, the most powerful of all the hindrances to success in teaching history. It appears even in the pupils, arising, not only from their unconscious sympathy with their teacher's feelings, but from their own growing experience of the overwhelming extent of this great field of knowledge. Indeed, the energies of teachers and pupils alike are crushed and paralysed by the vastness of their sub-

* Bain's 'Education as a Science,' 3rd edition, page 283.

ject; and it is felt by every one (though in many cases the thought is almost unconscious) that it is simply impossible for one mind to retain through life even the amount of history prescribed in the curriculum of an ordinary school. This feeling affects the minds of teachers and pupils in spite of themselves, and is shown in the aimless and half-hearted way in which they attack the study of history.

Accumulation of Needless Facts.—The problem seems to be how many facts to cram into a child's mind in so many years; whereas the true aim in the school teaching of history should be to select facts worth retaining, and to impress them on the mind in such a way that their acquirement forms a good mental discipline. It is impossible to do this without renouncing as impracticable much of the historical work that is now crammed into school years, and without courageously circumscribing our aims within a narrower compass.

And here it would be well to clear the ground by admitting at once that it is impossible, in an ordinary school course, to acquire a knowledge even of all that we consider indispensable in history: first, because time is limited, and much of it is required for other subjects; and, secondly, because, if due attention be paid to the evolution of the mental powers, it will be seen that the mind of a school boy or girl is not sufficiently mature to enter on the field of modern history, or even to reap the full benefit of general historical knowledge. To attempt such studies before the mind is ripe for them is a simple waste of force, and is even mischievous in cultivating that slipshod style of half-knowledge which is destructive of all real intellectual progress. But much may be done if too much be not attempted; and an immense increase of hopeful vigour would be thrown into the work if an attainable ideal were substituted for the present exorbitant and impracticable demands.

It may be objected that these demands are not beyond the powers of the children, and that this is proved by the creditable appearance many of them make in examinations under the present system. But how much this is the result of cram, and how evanescent such apparent knowledge is, may easily be demonstrated. For, if such children were again examined on their former acquirements (even on the work of the previous session), it would be found that few of them could answer in a way at all satisfactory, and many of them would have entirely forgotten the facts acquired with so much labour. Too often the sole practical result of a session in a history class is the high percentage of marks gained, or a certificate which is only valuable as a proof that the pupil once possessed a large amount of historical knowledge (?). The time spent, and the physical wear and tear involved, are too high a price to pay for knowledge which has almost completely passed from the mind, or, rather, for a passing acquaintance with facts which has left no impression except that of wasted power.

Let it not be supposed, however, that the imparting of knowledge is the only end we have in view in teaching a subject, for, in some cases, the only valuable result is, not the information retained, but the development of the faculties resulting from the study. What we maintain is that it is difficult to believe that such teaching as we have alluded to can have any beneficial influence in developing the faculties; for the superficial and imperfect acquisition of facts, in a temporary way, tends rather to weaken the mental powers. The axiom is worth being again repeated: The more thorough the knowledge acquired, the more perfect the mental discipline resulting therefrom; the better the method, the more satisfactory the result, both as to knowledge and discipline. This is amply proved by the educational success obtained in those branches which are best taught; as, for instance, in arithmetic, which is said to be the most advanced branch of education as regards scientific method.

The consciousness of real progress is one of the most powerful incentives to further study, and, of course, the everse is as discouraging. The discovery of ther superficial character of that historical knowledge which has cost them so much must soon be made by intelligent pupils, and forms an additional element in the feeling of hopelessness we have described. The contrast is very striking between this feeling and the bright sense of power and enjoyment which a child experiences who feels he is doing a little well instead of making feeble efforts after the vast impossible. Pestalozzi emphasises this strongly in the description of how he treated his eighty destitute children at Stanz, when he says: 'I was thus led to perceive what confidence and interest the child is inspired with by the consciousness of complete and perfect attainment.'

The pupil in history, besides being overwhelmed by the extent of the study before him, has his energies still further paralysed by the fact that, as Bain points out, history is taught simply as information, and therefore supplies no mental discipline, but lies on the mind a useless load of undigested facts. This results very much from the teacher failing to keep constantly in view the ends for which history ought to be studied. If that were done, the facts acquired would not be merely stored in the mind as information, but the pupil would be taught how to use them, and shown how the facts of history may be brought to bear on the practical concerns of life. This point will be brought out more strongly in its proper place.

(*To be continued.*)

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Science Notes.

EARLY SUN-GLOWS.—The remarkable sun-glows of last and the present year do not appear to be so wholly unprecedented in the world's history as many people seem inclined to think. A writer in 'Hardwicke's Science Gossip' says that researches in Scandinavian history reveal the records of several occasions, during the last three hundred and fifty years, in which similar sky phenomena have been observed in North Europe. Thus, in the summer of 1553, such a glow, or, as it was then called, fire-sign, was seen all over Denmark, Norway, and Sweden; and, strangely enough, a terrible plague visited those countries in the same year, its ravages in Copenhagen being so great that education at the university was brought to a standstill, and the students left the capital. The next after-glow was seen in 1636, and sailors who had cruised the North and Baltic seas reported that for weeks the skies after sunset seemed on fire. It was subsequently suggested that these strange appearances were probably due to the terrible eruption of Hekla, the great Iceland volcano, which occurred in the same year. Strange sun-glows are

reported as having occurred also in 1661, after a dreadful storm; in 1680; on Shrove Tuesday in 1707; and in 1783. In the last-mentioned year, the volcano Skapta Jökul, in Iceland, developed enormous activity, and to this eruptive violence may, no doubt, be ascribed the subsequent peculiar appearances of the sky.

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PETROLEUM IN PENNSYLVANIA. — The French Consul-General in the United States has just published some interesting statistics with respect to the above industry. The average yield of petroleum in Pennsylvania alone is said to have been, for the last few years, 775,000,000 gallons per annum, emanating from 20,000 oil-works. The total system of piping and connections is estimated at 5,000 miles in length, and the 1,600 reservoirs which exist would contain 38,000,000 barrels of oil, or enough to form a lake more than 100 acres in extent and 14 feet deep. The plan of conveying petroleum for long distances by means of large pipes or mains, rather than sending it by train, appears to be steadily gaining ground. The disastrous accidents which have frequently befallen petroleum trains in America have contributed not a little to this result, to say nothing of greater economy of the conveyance by piping after once the initial expense has been incurred. Some idea of the immense scale on which these petroleum works are conducted may be gathered from the fact that one corporation alone—the Standard Oil Company—are said to employ 100,000 workmen, and to use every day 25,000 barrels and 100,000 five-gallon cans.

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GENERAL STATISTICS OF THE BRITISH EMPIRE.—The following statements, abridged from one of the presidential addresses given at the August meeting of the British Association in Canada, may doubtless be accepted as trustworthy, and well up to date. The area of the British Empire may be set down as 8,650,000 square miles, with a coast-line of 28,500 miles, possessing 48 large harbours. The total population amounts to 305 millions of souls, of whom about 47 millions profess Christianity, 188 millions the various Hindu religions, chiefly Brahminism, and no less than 60 millions Mahometanism. England (including Wales) is the only part of the empire which is densely peopled throughout—its average per square mile, 485 souls, being almost exactly the same as that of Belgium, the most thickly-populated part of the European continent. With respect to mercantile shipping, out of 55,000 ships in the world over 100 tons, 21,000 are British; and out of 129 millions of tons carried yearly by the shipping of the world, 63 millions are under the British flag. With respect to shipbuilding, the figures are more startling still, for out of 1,800,000 tons built annually, 1,200,000 are built in Great Britain. The average sum earned per year per head in the United Kingdom is £34 4s., which exceeds that in the United States (£27 4s.), and that in Canada (£26 18s.), but is beaten by the Australian average of £43 4s., the highest in the world. The average rate for the continent of Europe is only £18 1s. As a sort of set-off against this is the public debt of the British Empire, amounting to the enormous total of 769 millions sterling for the United Kingdom, and 293 millions for India—in all 1,062 millions.

THE TWENTY-FOUR HOUR SYSTEM.—A neat and ingenious method for indicating twenty-four hours on a watch-dial has recently been contrived, which not only avoids encumbering the dial with a confusing double row of hour figures, but also retains the ordinary familiar and convenient twelve-hour spaces. The dial is made with twelve holes in place of the usual figures. During the first half of the day, midnight to noon, the figures 1 to 12, placed on a revolving disc at the back, show through; at noon the disc is automatically shifted, and the figures 1 to 12 are replaced by figures 13 to 24; at midnight, of course, the reverse action is gone through, and the figures 1 to 12 again appear.

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A CHINESE TELEPHONE.—At a late meeting of the China Asiatic Society, at Shanghai, a species of primitive telephone was shown by Dr. Macgowan, of Wenchow. It consisted of two bamboo cylinders, from 1½ to 2 inches in diameter, and 4 inches in length; one end of each was closed by a tympanum of pig-bladder, which was perforated for the transmitting string, the latter being kept in position by being knotted. This instrument goes by the name of the 'listening tubes,' and is employed for amusement as a toy, conveying whispers 40 or 50 feet. A similar sort of contrivance, manufactured out of a pair of large pill-boxes, is familiar to many lads in our own country.

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THE FORMS OF LEAVES.—A lecture on this subject was delivered on February 13th, at the Royal Institution, by Sir John Lubbock, M.P., and, as might well be imagined, proved very interesting. After tracing out the connection between the leaf area and the thickness of the stem, the lecturer demonstrated, by reference to numerous examples, how important an influence these two factors had in determining the shape of the leaf. In the Spanish chestnut, for instance, the stem was nearly three times as stout as that of the beech, and consequently could carry a larger leaf surface. But the distances between the buds were often little greater than those in the beech, and as this distance determined the leaf-width, it compelled the leaf to lengthen itself and assume the peculiar shape it did. Not only did the leaves on a single twig admirably fit one another, but they were also adapted to the ramification of the twigs, and thus availed themselves of the light and air, as we could see by the shade they cast without large interspaces or much overlapping. In the case of evergreen trees it was generally supposed that the leaves lasted one complete year. Many of them, however, attained a much greater age; in the Scotch fir, three or four years; in the spruce, six or seven; in the yew, even longer. It followed from this that they required a tougher and more leathery structure. When we had an early fall of snow our deciduous trees were often much broken down; glossy leaves had a tendency to throw it off and thus escape; hence evergreen leaves were very generally smooth and glossy. Considerable light was thrown on the subject of leaves by the study of the leaves of seedlings. Thus the seedling furze had trifoliate leaves, which gradually passed into spines. This showed that the furze was descended from ancestors which had trifoliate leaves, as so many of its congeners had now.

How to Teach Drawing in Elementary Schools.

BY T. R. ABLETT,

Superintendent of Drawing to the School Board for London.

How to teach drawing in elementary schools has only just been found to be a matter of national importance in England. It has been recognised as such in France, Belgium, and other countries for some time. Early in 1883, I pointed out, in a lecture on my visit to the schools of Paris, that the French were promoting art-teaching in elementary schools in a way quite without parallel in England. At the Health Exhibition (1884) the drawing shown by our leading School Boards was estimated by the jurors to be far inferior to that exhibited by similar foreign institutions. It has been shown by the Royal Commissioners on Technical Instruction that our artisans and operatives must possess skill in drawing if they are to compete successfully with those of other countries. The thirtieth report of the Science and Art Department states that nine-tenths of the artisans who ought to learn to draw do not attend the schools of art or art classes. How to teach drawing in elementary schools, so that the graphic language of the workshop may be known to those who need it, is a matter of first importance in any steps we take to maintain England's supremacy in manufacturing.

Happily, the drawing that workmen most need is based on practical and solid geometry. These demand no special ability for drawing, but only that general intelligence which the parchment of an elementary teacher guarantees. This being the case, there will be no difficulty in making geometric drawing an essential subject in elementary schools, since every teacher possesses the capacity that will secure the attainment of a knowledge of drawing plans, elevations, and sections, such as will be sufficient to enable him or her to teach it in a good and useful way.

In a statement of the methods I advocated, which was made to the Royal Commissioners on Technical Instruction at their request, these considerations led me to say that 'the drawing that all can learn should be taught to all, and form as definite a part of elementary education as does writing.' In the report, since published, of the Commissioners, the first recommendation is as follows: 'That rudimentary drawing be incorporated with writing as a single elementary subject, and that instruction in elementary drawing be continued throughout the standards.'

As geometrical drawing is that which all elementary schoolmasters and schoolmistresses can learn to teach, it follows that it is that which the vast majority of children can learn. On this account, and because it will be more useful in after life than any other branch of drawing, by reason of its technical bearing, I propose to consider the teaching of this subject first. It would seem convenient to divide the course proposed in such a way as to provide each standard, up to the sixth, with suitable work.

Geometric or Technical Drawing.

Standard I.—The simple use of a rule.

1. *Manipulation.*—Each pupil must be provided with a nine-inch or a foot rule, on which the inches are divided into twelfths, and the half and quarter inches are shown. The teacher must be provided with a two-feet rule or yard measure, divided in the same way.

Show, by placing a foot rule on the blackboard, that the first and second fingers of the left hand must be placed near one end, and the thumb near the other, in order to press it firmly down. In the manner shown, let the pupils, at the word of command, hold the rules diagonally, or up and down the slates or pieces of paper. For ruling lines across, the fingers only can be used to hold the rule.

With a long piece of chalk, cut at the end like a chisel in shape, show how the pencil must be held so that a line may be ruled exactly where the rule touches the blackboard as in Fig. 1. It must not be held so as to

Fig. 1.

leave a space between A and B, as shown in Fig. 2.

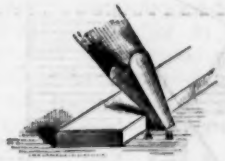


Fig. 2.

Let the pupils rule lines at the word of command across, diagonally, and up and down the slates or pieces of paper. Several lessons will need to be taken up in securing dexterity in these exercises in manipulation.

2. *Ruling Parallel Lines.*—The term 'parallel' need not be used or explained at present. See that a line is ruled straight across each slate, of some given length—say five inches—and that a given distance—say three inches—is marked directly under each end of it. Between the two points thus marked see that a line is accurately ruled. A number of similar exercises must be given in which the inch division only should be employed. The parallel lines may be placed, on the slate, in any position already practised. Constant illustration must be given by the teacher. Every new step should be drawn in the first place on the blackboard. It is very necessary that the blackboard should be placed on the easel as the slates are placed on the desk. If the length of the slate runs with the length of the desk, the blackboard should be similarly placed on the easel, and so on with any other position.

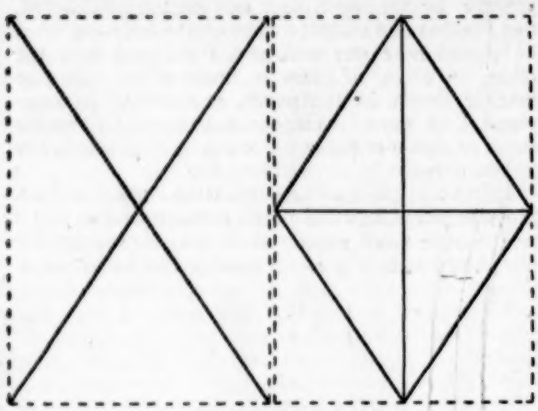
So far the work may be fairly spread over five or six lessons.

3. *Exercises in Ruling.*—The following exercises are designed to be worked on a slate or piece of paper nine inches long by six inches broad.

(N.B.—The dotted lines indicate the edges of the slate in each exercise.)

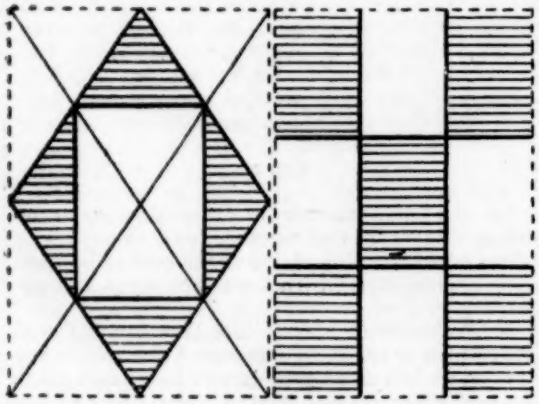
Exercise 1 is the simplest, and Exercise 12 represents the most difficult that should be given. If these exercises are not found sufficient, others of a similar character may be intermixed with them.

Exercises 1, 2, 3, 4, 5 should entirely fill the slate. The teacher should show how to work out the pattern



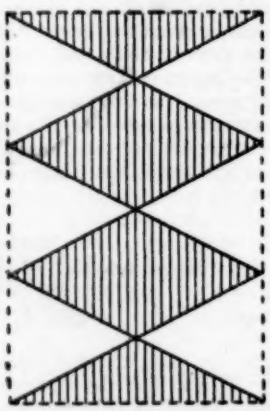
Exs. 1 and 2.

by using a slate held before the class. One line at a time should be first measured, and then drawn, and



Exs. 3 and 4.

the scholars should follow step by step, working on their own slates. A little careful instruction will



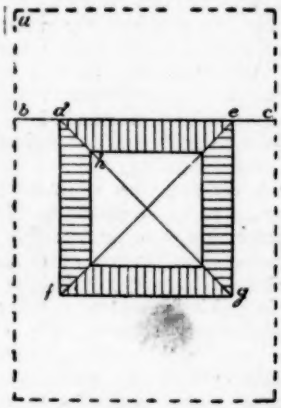
Ex. 5.

enable the pupils to do the shading fairly well. The teacher, having ruled two lines on the blackboard, as in Fig. 3, will, with the free hand, draw the line at *a*

Fig. 3.

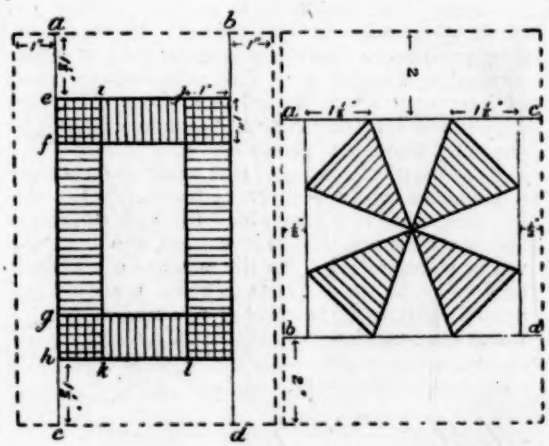
as it ought to be done, and then point out, by drawing lines at *b*, *c*, *d*, and *e*, the faults in beginning and leaving off to be avoided.

In Exercise 6 the distance *ab* (2½ inches) is first marked on both sides of the slate, beginning at the



Ex. 6.

top; *bc* is ruled; *bd* (1 inch) marked off; *de* (4 inches) measured; *f* and *g* measured 4 inches below *d* and *e*



Exs. 7 and 8.

respectively; the sides of the square *d*, *f*, *g*, *e* ruled; the diagonals *dg* and *fe* ruled; *dh* (1 inch) marked off

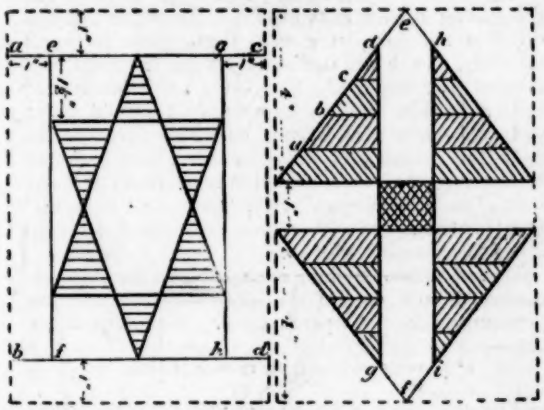
on the diagonal, and similar distances from *f*, *g*, and *e*; the inner square is completed, and finally the spaces are shaded.

In the rest of the exercises the marks " will indicate inches.

In Exercise 7 first mark off the points *a*, *b*, *c*, *d*, and join *ac* and *bd*. Measure *ae*, *ef*, *fg*, *gh*, on both these lines, and rule lines across. Measure off and mark *i*, *j*, *k*, *l*, and rule *ik* and *jl*. Shade.

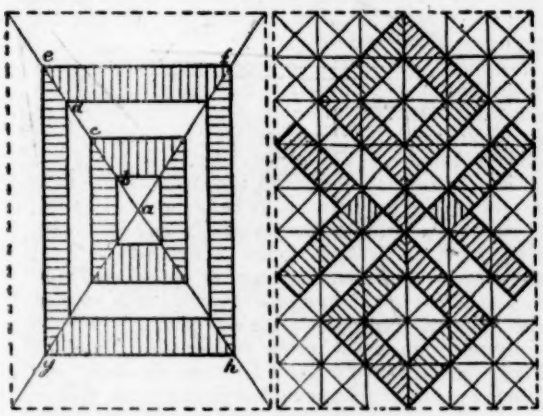
In Exercise 8, measure off and mark points *a*, *b*, *c*, *d*, and rule lines *ac*, *bd*. On these lines measure off ½" from each of the points *a*, *b*, *c*, *d*, to mark the points of the square. Rule the remaining sides of the square. Mark off (1½") from each corner of the square, and rule the lines of the shaded figure.

In Exercise 9, measure off *a*, *b*, *c*, *d*. Rule *ac*, *bd*. Measure off points *e*, *f*, *g*, *h*. Rule *ef*, *gh*. Measure off the points of the shaded figure, and complete it.



Exs. 9 and 10.

In Exercise 10, measure off (4") from the top and bottom of the slate on both sides, and rule two lines across it. Measure off *e* and *f*, the middle points of the top and bottom of the slate. Rule line *e*, *d*, *c*, *b*, *a*,



Exs. 11 and 12.

and the three similar lines. Measure off *ed* (1"), and the similar distances like it. Rule *dg*, *hi*. Rule lines across from *c*, *b*, *a*, and from the other points similar to them.

In Exercise 11, rule the diagonals. From *a* measure off points *b*, *c*, *d*, *e* (1") apart. Mark off similar distances on the other diagonals. Rule *ef*, *gh*, *eg*, *fh*, and then the other lines, to complete the figures.

Exercise 12 is very simple, but needs to be accurately ruled. Divide the top, bottom, and sides of the slate into inches. Rule the lines across, and then the vertical lines. Rule the diagonal lines. Shade the pattern, and finish by ruling the outlines of it rather darkly.

3. *Vertical, Oblique, and Horizontal Lines.*—Hold a rod in an upright position on the floor before the class, and tell the pupils that a line in this position is named a vertical line. See that a line is drawn straight down each slate to represent the rod, and instruct the pupils always to show vertical lines in that position on the slate or paper.

Call attention to the fact that the surface of still or tranquil water is always quite level; that a good floor is always quite level. Hold a rod parallel with the floor, and tell the pupils that a line in this position is named a horizontal line. See that a line is drawn straight across each slate to represent the rod, and instruct the pupils to show every horizontal line in that position on the slate or paper.

The teacher should stand facing the class, and hold a rod so that one end will be on the floor and the other sloping towards his or her right-hand side. The pupils must be instructed to rule a line from the left-hand top corner of their slates or paper to the right-hand bottom corner to represent the rod. In the position above-described, the teacher should then hold the rod sloping towards his or her left-hand side. To represent this, the pupils must be instructed to rule a line from the right-hand top corner of their slates or paper to the left-hand bottom corner.

The pupils may be told that these latter lines are named oblique lines. It is not of great importance that these names should be taught at this early stage. In deciding whether they should be mentioned or omitted each teacher must use his or her discretion. It is, however, of the greatest importance that pupils should well understand in what position, on paper, lines of different direction are pictorially represented.

The work which has been indicated up to this point is an excellent preparation for drawing to scale. That it may afford good training, great care must be enforced in all the measuring and ruling. If at any time an exercise is found to be rather beyond the scholars, the teacher should go back to simpler ones, such as those the pupils have already mastered. The great secret of getting good work from young children will be found in giving simple directions, one at a time, and in seeing that each one is carried out by the whole class before another is attempted.

Easy drawing to scale, for Standard II, will be next considered.

Lectures on Shakspere's 'Tempest.'

BY H. MARMADUKE HEWITT, M.A., LL.M.,
Late Assistant-Examiner in the University of London.

No. I.—As far as Act I., Sc. 2, Line 188.

(The figures in brackets refer to the pages of the Clarendon Press Edition.)

A play of Shakspere is no easy study for a young

student. This English author, no doubt, is the prince of dramatists; but the English of his day was very different from the English of our own time. Much of his language, too, must have seemed obscure and difficult of comprehension, even at the time when it was written, unless we are to suppose that the illiterate of the reign of Queen Elizabeth had an intuitive knowledge of the great principles of grammar and language, which even students nowadays find it difficult to acquire. But few books, we imagine, are better adapted to form a vehicle of educational training.

I shall say little as regards the story. The least industrious pupil may probably be trusted to make himself acquainted with thus much of his work. Nearly every candidate will be able to put on paper that the play contains the story of a famous duke who studied magic, and, through want of caution, was deposed from his dominions by a wicked relative; that, by a wonderful coincidence, the ship which carried this wicked brother was wrecked upon the enchanted island where Prospero, the duke, and his fair daughter, Miranda, had taken up their abode; that among the characters of the piece are Ariel, a tricksy sprite, Miranda, a young princess, who had never seen a man, and Caliban, an odious but somewhat laughable monster. Many young beginners have read Lamb's 'Tales from Shakspere.' If any have not done so, it is time they looked into the little volume for the story of the 'Tempest.'

But what is mainly required of our young friends is a knowledge of the grammatical difficulties and the peculiarities of diction and expression which this play contains. From a study of these they will learn the great fact that language is not a thing that 'abideth in one stay,' but one that, on the contrary, is perpetually changing. In reading Shakspere we shall meet, not only with many new words (that is to say, words that are new to us), but with many old words that have a different meaning from that which they bear in ordinary use. There will also be phrases and combinations of words which, until we have smoothed them out, so to speak, or picked them to pieces, will convey very little meaning to youthful minds. Let us plunge at once, then, *in medias res*, and cull a few samples of the difficulties just mentioned.

Let us take, to begin with, some of the nouns substantive. *Teen* (5) is an old word meaning 'sorrow,' and is probably of Anglo-Saxon origin. In 'Romeo and Juliet' occurs the passage: 'And yet to my *teen* be it spoken.' *Amazement* (4) evidently means something more than mere astonishment; the context shows that it means 'distress of mind.' It would be worth while for the student to compare the use of this word in the 'Form for the Solemnisation of Matrimony.' *Abysm* is, of course, only another form of 'abyss.' *Manage* is frequently used by Shakspere with the meaning of 'management.' What does the student suppose the poet to have meant by *zenith* in the passage—

> 'I find my zenith doth depend upon
> A most auspicious star'?

Here, clearly, *zenith* cannot bear the meaning that the dictionary gives us, viz.: 'the point in the heavens vertically overhead.' This, of course, is the literal signification, but it has evidently undergone a change of meaning by being adopted among the metaphorical utterances of the poet. What Prospero is speaking of is his own future; and perhaps 'my future progress,' 'my up-rising,' and 'my passage from misfortune to the height of prosperity' are all expressions which indicate this meaning with some degree of exactness, though none of them are quite accurate. It is worth noticing, too, that *influence* meant originally the supposed effect of the heavenly bodies upon the destinies of human beings.

The exercise of parsing affords one of the best tests of grammatical knowledge, and more especially of the student's grasp of general principles. Unless these have been mastered thoroughly, a skilful examiner can easily land the student in a dozen blunders in a single page of Shakspere. 'Would you be surprised to learn, sir?' he might say (adopting a famous form of interrogation from the now historical Tichborne trial), that I doubt your ability to parse correctly the words *advantage*, *fain*, *full*, *out*, *backward*, and (perhaps) *confederates*—all of them expressions which occur in the first half-dozen pages, or thereabouts, of the play you are getting up for examination? Does this put you on your mettle? Very well, then, parse them all correctly, and I will apologise for my mistaken estimate of your faculties.' Now, were I the 'examinee' (if I may coin such an expression), I should parse them as *neuter verb*, *adverb*, *adverb of degree*, *adverb* (with the meaning of *quite*), *noun abstract*, and *verb neuter* respectively. I should also consider that the words 'profit,' 'willingly,' 'very,' 'quite,' 'background,' and 'conspires' were fairly good equivalents, if I were asked to 'paraphrase' them.

Do you notice anything remarkable in the pronunciation of any of the words? How was *revenue* pronounced in Shakspere's time? Well, look at the line—

> 'Not only with what my revenue yielded,'

and you will see at a glance that the accent falls upon the last syllable but one, called in scholastic language 'the ante-penultimate.' As regards the word *extirpate* ('pluck up by the roots'), it was probably the exigencies of the metre that induced the poet to write—

> 'Should presently extirpate me and mine.'

Here the accent is the same as in the word *revenue*. Did you notice, too, that *fire* is a dissyllable at the beginning of Scene 2?

We meet with certain apparent abbreviations, such as *tend*, *hand*, *ope*, which are the equivalents of our modern 'attend,' 'handle,' 'open.' The word *incharitable* would, of course, be 'uncharitable' in modern English. *Un* is the Saxon, *in* the Latin prefix. Something might be urged in favour of the employment of the Latin prefix before a word of Latin derivation ('charity' is from *caritas*), and according to this view, *incharitable* would be the more correct expression. However, custom has decided against it. In the expression, '*your piteous heart*,' it is evident that 'piteous' bears the sense of 'pitying.' We are accustomed to speak of 'a *pitying* heart,' and 'a *piteous* (or pitiable) story.' '*Lie there, my art.*' *Art* here is not an abstract noun, nor does it mean skill in magic. It is rather the prophetic mantle—the *badge* of the astrologer or magician.

As regards grammatical construction, few grammarians would regard the inquiry, '*What cares these roarers?*' as a specimen of correct English writing. 'Cares,' they say, should be written '*care*.' Precisely

so; and yet in Shakspere we meet with scores of instances of this construction. It must be remembered that the poet is depicting the language of uneducated people. But the usual scholastic explanation is this. The thing or phenomenon indicated by the words *these roarers*, forms in the mind of the speaker only a single idea, such as might have been expressed by 'this turbulent sea,' or 'this body of water.' Then, in the hurry of speaking, the plural expression is allowed to be followed by a verb in the singular. Recollect this explanation by all means, and quote it if asked to explain the passage, but remember that such license is never allowed to humbler individuals. Shakspere puts *who* after a neuter antecedent when it is personified, and writes 'a vessel *who*' etc. (3). *Who* is put for the objective *whom* in the expression '*who to advance*' (6). Again, I suppose few schoolmasters would admit the correctness of '*twelve year since*' (5); and yet even educated people will sometimes say 'twelve stone six' and 'twelve pound ten.' How arbitrary is custom! But what can we possibly think of 'more better' (4)? Almost any first-form urchin would decry this as a 'double comparative.'

Notice the expressions *but nobly*, meaning 'otherwise than nobly (or favourably),' *in lieu of*, which means 'in return for,' and *in few*, which means 'briefly,' or 'in few words.' Also *but ever* (9) for 'some time or another.'

I will now quote one or two passages of somewhat greater difficulty. The first of these is *to trash for overtopping* (6). The substance of the long note in the Clarendon Press edition is this, that the phrase means either 'to chastise for getting too far a-head,' or 'to prune or cut down for exuberant growth.' The expression is supposed to be derived either from the hunting-field or from gardening, and the object 'trashed' is either a dog or a tree. Whatever the origin of the expression, the meaning is obviously to 'check' or 'keep in order.' '*Louder than the weather or our office*' occurs earlier in the play. The question is what is meant by '*office*,' for, in the ordinary signification of the word, it can scarcely be called '*loud*.'

Of course, the student will detect the derivation of *office* from the Latin *officium*, which means 'duty.' Now, one of the 'figures of speech' is that called metonymy, by virtue of which the name of one thing is put for that of another with which it is nearly connected. We shall enlarge upon this principle in future lectures; but in the meantime it will be sufficient to remark that in this passage *office* must mean not 'duty,' but the cries made by the sailors in the execution of their duty. To these the epithet 'loud' may be applied with perfect propriety. On the same principle, *time or vainer hours* (9) is put for 'time for lighter occupations.'

We have pointed out some of the difficulties which occur in the commencement of this play. We propose to treat of the others in future lectures.

Gossip.

WITH this number we once more begin a new volume. We desire to draw the special attention of every teacher in the country to Mr. Ablett's introductory paper on 'How to Teach Drawing in Elementary Schools.' When the New Code makes its appearance we believe 'Drawing' will be made a compulsory subject, and placed on pretty much the same footing as the three R's. No practical teacher in this—or, for that matter, in any other country—is better qualified to speak on this subject than Mr. Ablett, who, at some inconvenience, has generously promised us a series of papers.

We trust our readers will make these special articles as widely known as possible.

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In another part of this issue we print the first of eight 'Lectures on Shakspere's "Tempest."' As, exclusive of 'certificate candidates,' there must be about 10,000 pupils reading this play for the next Cambridge Local Examination, we cannot but think its appearance will be hailed with warm approval.

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Students should, however, never confine themselves to one set of 'Notes'; it is always better to read two or three. For this reason we avail ourselves of this opportunity of strongly recommending that edition of the play published by the Messrs. Chambers. The 'Notes, etc.,' are full, and just of the kind needed by 'certificate candidates.' The book has the additional merit of being moderate in price.

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Educationists generally will be glad to hear that at last we are to have the mysteries and excellencies of 'Slöjd' explained to us. Miss Warren, at present Inspectress to the Leicester School Board, studied 'Slöjd' in Sweden, and has kindly promised us a few articles explanatory of the system for the PRACTICAL TEACHER.

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This genial little lady is, we understand, also busily engaged with several 'inventions' for infant schools. Should the high hopes entertained of them be realised, every teacher of 'babies' will look upon Miss Warren as a benefactress of the rising generation.

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Professor Bain, at present engaged upon recasting his excellent 'Grammar and Rhetoric' (Longmans), may also be expected, health and time permitting, to contribute two or three papers on English to our new volume.

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We hear that Messrs. Marcus Ward and Co. have nearly ready for publication a *coloured* illustrated Primer, compiled by one of the youngest, most energetic, and talented of Her Majesty's Inspectors of Schools.

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We are sure a large number of our readers will await with unusual interest the publication in England of M. Paul Bert's 'La Première Année d'Enseignement Scientifique.' Of the famous French physiologist's well-known work, upwards of half a million copies have already been sold in his own country. The book has also been done into Italian. All science teachers should make a note of this forthcoming manual, which we learn upon good authority is likely to be particularly rich in illustrations. It will be issued by Messrs. Relfe Brothers, Charterhouse Buildings, Aldersgate, E.C.

From Mr. Step, whose 'Plant Life' was noticed in a previous issue of this journal, we have received a letter, in which he charges the reviewer of his book with exhibiting 'the cloven foot of animosity—a spirit which seems to tincture the whole review.' In reply thereto, the writer of the notice in question says :—

'The only animosity I had in writing my review of "Plant Life" was animosity against ignorance and pretension. I know nothing whatever of Mr. Step. But I know his book. In your columns I pointed out thirty-seven errors, more or less gross. These were only a part of the errors contained in "Plant Life."'

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We regret that the exigencies of space forbid us giving both letters fully. To the fourfold complaint of the author, the reviewer, in our opinion, furnishes a thoroughly satisfactory and adequate answer.

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Mr. Step finally asks 'If the critic honestly believes in the opinion he has expressed, why should he waste so much of your valuable space over so small and so bad a book?' Here is the said critic's reply :—'I do not consider it waste of space or time to deal at length with such a book as Mr. Step's. It is elegantly got up, well-illustrated, published by an eminent firm, deals with popular subjects and in popular language. It teems with blunders from one end to the other. On these grounds, as a book distinctly dangerous to young or uncultured minds, it deserves a castigation more severe than I had the power to inflict. Books such as these poison the fountain of scientific life at its source.'

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We have only to add that the writer of the above ines is without doubt one of the ablest botanists living.

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Mr. A. Johnston (6, Paternoster Buildings, E.C.) has just published an excellent set of Standard Copy Books. The series, which consists of seventeen books (including an Infant Kindergarten number), is most carefully graduated, printed on exceptionally good paper, and abounds in just those helps in the need of which young beginners so much stand. We cordially recommend these new candidates for public favour. Specimen pages may be had on application to the publisher.

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Readers of the *Pall Mall Gazette* will remember a series of stirring sketches which recently appeared in that journal, under the title of 'School Board Idylls.' Mr. Runciman, so well known in the profession, is the accomplished author of these stories, which abound in grim pathos and humour. Seven of them are now sent forth to the world by the Messrs. Longmans. Unbelievers in over-pressure should invest a modest shilling in this neatly-clad little volume. They would rise from its perusal wiser men and women.

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Teachers will be glad to hear that Messrs. Chambers have just published another admirable collection of 'Short Stories,' suitable for composition exercises.

Publications Reviewed.

Local Examination History. By Dr. R. S. Pringle. Manchester and London : John Heywood.

The rage for examinations and the variety of subjects to be prepared has rendered the compilation of books giving answers to what may be likely to come as questions almost absolutely necessary. We deplore the necessity for this, as it can only lead to the acquisition of a superficial knowledge of the subjects of which the books may treat. The book under notice has been compiled, as its title indicates, expressly for those pupils who intend sitting at any of the University Local Examinations. The author is a practical teacher, and in the preface says that 'not one of his candidates has ever failed in the history paper.' This speaks well for the book, so far as satisfying the examiner goes, and the book thus carries with it a strong recommendation to those who seek only the success which can be thus attained. As a 'cram book' it is very suitable ; as a text-book it falls much below what we could desire. The different periods or reigns are treated in short paragraphs under separate heads, the paragraphs themselves often having no connection. There is thus no sequence in the history, and it would be very difficult in many instances to see what connection the isolated facts have one with another. Brevity seems to have been considered as much as any other requirement, and so we have the characters of many of the sovereigns summed up in two or three words—*e.g.*, 'brave and generous,' 'prodigal and cruel,' 'a coward, tyrant, and liar,' 'brave and forbearing,' 'brave, but fond of dress,' 'amiable, but unable to rule.' Now it is absolutely impossible for any one to get a fair idea of the characters of the kings from such short summaries as these, dissociated as they are from the acts upon which the writer's estimate of the kings' characters has been formed. Similarly the desire for brevity has often led to inaccurate or incomplete description. This is the full description of the Venerable Bede : 'The Venerable Bede was a monk distinguished for his learning.' Again, 'Cerdic, the first king of Wessex, from whom all the Saxon kings were descended.' Harold II. was a Saxon king, but not descended from Cerdic.

The principal events are treated in a similar manner. How they came about, or why or wherefore they should have taken place, is shrouded in mystery, so far as this book is concerned. Take as examples the following selected at random : 'The Burmese War (1824) resulted in the annexation of Tenasserim, Assam, and Aracan.' 'The Battle of Navarino (1827) : In this battle the English, French, and Russian fleets destroyed the entire Turkish navy, and obliged Turkey to acknowledge the independence of Greece.' 'Battle of Zutphen (1586) : The English were defeated by Philip of Spain, and Sir Philip Sidney slain.'

The reign of Victoria occupies one-fourth of the volume, and so far as this period is concerned, the charge of want of fulness cannot be brought against the book ; on the other hand, we scarcely think it necessary that the names of nearly two hundred eminent persons, prose and poetic writers, etc., should burden the pages of the book or the memory of the pupil, especially when 'The Claimant,' 'Grimaldi,' 'Moirosi,' and 'Sekukuni,' are considered worthy to be reckoned among the number.

If the book were intended only as a companion to some more important history, our strictures would be uncalled for, but from several paragraphs in the preface we are led to conclude that the author believes it sufficient for a school-book, and we have thus been led to point out a few of the points in which we consider the book as defective.

Geographical Readers. By Charlotte M. Mason. Book V. The Old and the New World. London : Edward Stanford, 55, Charing Cross.

This is a well-written book of 325 pages, and is very suitable as a reading book for the sixth standard The

lessons are varied and interesting, quotations being given from several authors. The book has no illustrations or lists of words, but it has many maps which would serve as models for imitation by the children, and the questions on the maps have been carefully prepared. No sixth-standard lad who could answer these questions and draw the maps could possibly be considered ignorant of the subject, or fail at the examination.

Materials for Object Lessons. By Charles McRae, M.A. London and Edinburgh: W. and R. Chambers.

This book does not profess to be a book of method, but the compiler has brought together in a narrow compass sufficient information for lesson purposes on nearly fifty different subjects. To those who have not access to books of reference the work will be useful, but it will, we fear, be the means of sometimes preventing that independent research the necessity for which is of very considerable value in forming habits of study. The materials collected are full and carefully arranged, and need abridgment only to make them fit for notes of lessons on the subjects of which they treat. Five specimen 'Notes of Lessons' are appended. As the lessons are nearly all on common objects, infants' teachers will find here almost all they need for the year's course of oral lessons to their higher classes.

Murby's Excelsior Reading Books. First and Second Readers. London: Thomas Murby, Ludgate Circus Buildings, E.C.

These popular Reading Books have been enlarged by the addition of matter from another series, so as to bring them into conformity with the requirements of the Mundella Code as regards number of lessons and pages. They are so well known that they do not need any recommendation, and the price at which they are issued brings them within the reach of the poorest classes of schools.

Select Poetry for Recitation. Standards I.-VII. London and Edinburgh: W. and R. Chambers.

This selection of poetry is issued in five little books. The pieces have been well chosen and on the whole carefully graduated. The notes are full and clear, and those to the longer pieces are placed at the foot of each page. We can recommend the books to teachers who find that the selection in their Reading Books is not sufficiently varied to satisfy the requirements of the class subject—*English*.

Differential Calculus for Beginners, with a Selection of Easy Examples. By Alexander Knox, B.A. Cantab. London: Macmillan & Co. 1884.

It has always seemed to us that an ideal course of mathematical teaching would introduce the Differential Calculus at a much earlier period than that at which it is ordinarily taken; for in the first place it is the key, and the only key, to that marvellous and intricate labyrinth of Higher Science, every path of which is a journey into a country so strange and so fantastic that a lifetime is insufficient to explore any but the smallest portion of the wonders to be met with there. The ideal book should render easier the climb of the mental Hill Difficulty by some picture of the view which is to be expected from the top. The books at present in use do nothing of the sort. They are full to overflowing of analytical processes, all of great power and ultimate utility—many, too, of great intrinsic beauty. But no hint is given of that utility, and as often as not, we fear, for the writer himself the beauty is non-existent. To change the figure for the third time—there is nothing to animate the Valley of Dry Bones; and hower perfect, anatomically speaking, those bones may be, in the absence of cartilage and muscle and colour and life, they never cease to be repulsive. But there is another reason for the earlier introduction of the Calculus, and this is found in the light thus thrown on all the parts of mathematics usually regarded as elementary, but not, on that account, by any means easy. The facts of Co-ordinate Geometry are thereby shown to be co-ordinate in a higher sense. Geometry itself is freed from many of its fetters by the same strong hand; while we are at once provided with a new power of calculation and, what is still more important, verification.

It is worth while quoting for a second time an observation of the great Carnot's, given by Williamson in his work:—

'La mérite essentiel, le sublime, on peut le dire, de la méthode infinitésimale, est de réunir la facilité des procédés ordinaires d'un simple calcul d'approximation à l'exactitude des résultats de l'analyse ordinaire.'

Now this work 'de réunir' is precisely what Mr. Knox has tried to do, but he has not, in our judgment, done it by any means well. He takes the ordinary process of Successive Differences, which is pure Arithmetic, and by a slight extension of it shows that we are led to the numerical values of the Differential Coefficient. As a *verification* of the results, nothing better could be desired, but half the book is taken up with processes of the sort. For example, in the case of Sin x we are first given a geometrical proof of the theorem $\frac{d}{dx}(\sin x) = \cos x$, which is quite unexceptionable; and we are then treated to the verification of this equation in the case of $x = 70°$. Thus:—

Sin 70°	= ·9396926
Sin 70°·0001	= ·9396932
Angle Increment	= ·0001° or in circular measure ·000002
Sine ,,	= ·0000006
Diff. coefficient	= ratio of second increment to first = ·3
	= cos 70° approximately.

This is all very well, and, so far as we remember, a novelty in treatment for which Mr. Knox deserves credit, but it occurs on the 62nd page of the book and no less than 18 previous pages, the whole book being only 112 pages, are filled with work of the sort which is often unnecessarily tedious, and might in almost every case have been left to the student more profitably than done by the teacher.

Having mentioned this, we have mentioned all that is new and most that is good. Many of the articles appear in ordinary algebra manuals, and their repetition is unnecessary; for example, Sec. II. is devoted to the meaning of $a \times 0$, and $\frac{a}{0}$; Sec. IV. to that of a Vanishing Fraction; Sec. XV. to the meaning of x^0 (*apropos* of nothing particular in the rest of the book, so far as we can see). This last section is very incomplete, even if it were not unnecessary, for it does not prove that the limit of $x^a = 1$, when a approaches zero from the *negative side*. This is not the only case of inaccuracy. Newton's Lemma VI. is introduced, without a warning to prepare us for its sudden advent, and a supposititious proof is given which is not Newton's and is not true, inasmuch as it assumes the very point of the whole Lemma that the part of the curve considered has *continuous* curvature, and unless this were true the angle between consecutive tangents would not vanish at the point of discontinuity.

We have one other very serious objection to make. It is in our opinion absolutely fatal to a boy's chance of a successful mathematical education that he should be taught to say, to see, or even to hear such a phrase as 'differential coefficient of 1^2, 2^2, . . .' (p. 35 and *passim*). To say, as Mr. Knox does, that 1 is supposed to receive small increments of ·01 is to talk nonsense, which will go far to ruin any notions of that tender question of unity which the boy may happen to possess. No amount of previous explanation, no repetitions of 'let us suppose' can possibly justify it. The meaning, of course, is obvious, but in nine cases out of ten this very obviousness will result in the perversity of human nature assigning another and false meaning tc the phrase. Even boys who have

never been taught to differentiate the square of unity often argue thus :—

$$\left\{\begin{array}{l}\text{To solve the equation } x^3-3x+2=0\\ \text{Differentiate } \therefore\ 3x^2-3=0\quad \therefore x=\pm 1\end{array}\right.$$

and they would be vastly gratified on finding that one value so obtained did actually satisfy the original expression.

The notation adopted for n^{th} differentials is bad, inasmuch as it does not indicate the variable with respect to which the differentiation is to be performed. When one variable only occurs this is perhaps not very necessary. Thus $dc_n x^n = \lfloor n$, is an obvious statement, though the only purpose that c serves is as a bad mnemonic, but when we come to $dc_n a^n x^n$ it is by no means a good symbol to be used, especially by one who has been taught the deep art of finding the successive differentials of constants.

There are several other remarks which we should have made if more space had been at our disposal. We are convinced that it is a false principle to put in a book much of that 'lecture-talk,' if we may be permitted the expression, which any teacher who understands his subject will be able to coin for himself in the exact amount required by the dulness of his class. Boys won't read 'talk.' They will only read what is necessary to enable them to answer the teacher's questions, and the only method of getting them through such parts is to have them up at the blackboard and drill it into them until a pleased smile betokens dawning intelligence.

The real difficulties of the subject are not reached by Mr. Knox's book. Partial Differentiation is still in the shady future, for at the end of 112 pages we have advanced no farther than the incorrect proof of Maclaurin's Theorem, and this only in an appendix. For the purposes of an advanced student revising this renders the book useless. It will be in our opinion equally useless for the beginner, through the wild confusion of the arrangement and the repulsive appearance due to whole pages full of seven-figure decimals.

We do not like to leave any honest endeavour without a word of praise. The name of the publishers is sufficient guarantee for a book whose appearance is eminently neat, and having looked carefully through the pages and worked some fifty of the examples we can certify to its general accuracy.

Experimentum Brevissimum. By Hubert T. M. Horne. London: Elliot Stock, 62, Paternoster Row.

The second title of this book is 'A Concise Critical View of English Grammar, from a Mathematical Standpoint.' We are careful to give it in full, for the reason that the writer seems to think that the whole subject of English Grammar may be despatched in some fifty pages, the whole book containing but eighty-two pages, the first twenty-nine of which are occupied by the introduction. This introduction is very largely made up of quotations from the 'Primer of Philology,' Dr. Smith on 'Tacitus,' and the writer's own attempts to show that 'good language is only a modification not less a multiple of bad language' (whatever that may mean), and in examining several forms of what he calls 'good grammar.' Then come some 'Preliminary Remarks' and thirteen 'Axioms,' to many of which any one might take exception, and to some of which the writer himself practically objects in the subsequent pages. In the two chapters which form the actual work, the writer examines a few inflexional and syntactical irregularities, such as whether we should use the Latin or English form for the plural of Latin words; the use of the apostrophe, and of 'who, which, and that'; the use of auxiliaries in the subjunctive mood, etc., and decides as to their use according to the axioms which he himself has laid down. The book is of no practical value, but teachers might place it on their shelves as one among the number of books which will amuse them when they are wearied with more arduous study.

Summary of English History. London: Jarrold and Sons, 3, Paternoster Buildings.

This book does not profess to be a history, but a chronological summary of the events of English history to be used only as 'serving to fasten upon the memory the salient points of a reign;' after the study of a larger and more connected work. As such the book may be safely recommended to scholars, pupil teachers, and scholarship candidates. The information is clearly given and—considering the size and purpose of the book—full and accurate. The sections which deal with the religion, government, and trade of the separate periods, after the chronological lists, are well written.

The World at Home. Standard VI. London: T. Nelson and Sons, Paternoster Row.

This is a worthy continuation of the admirable series of geographical reading-books published under the above title. It deals with Asia, Africa, North and South America, and has lessons on climate and the zones, as well as a very carefully compiled table of interchange of productions of different countries. To each division of the globe treated of there are introductory chapters, which give the physical and political features of the continents. The reading lessons consist of accounts of travel, descriptions of the scenery, buildings, and the wonders of nature in these far-off lands, and particulars of those plants and other vegetable products which form a very large part of the commerce of the world. There are numerous illustrations of a superior character, and maps suitable for copying as well as serving to illustrate the text. We have seen the book placed in the hands of a large Sixth Standard for the first time, and a pretty good idea may be formed of the interesting character of the lessons from the fact that there was no need to look after the lads so long as they had the volumes in their hands. We can heartily commend the whole series to the notice of our readers.

The Intermediate History. London: T. Nelson and Sons, Paternoster Row.

This history is one of the Royal School Series of English Histories, and occupies an intermediate place in the series, both as regards amount of detail given and difficulty of language employed. It is a complete history of England from the earliest times to the reign of Queen Victoria, and is designed to serve as a text-book and a reading-book combined. The plan of the work is to give a summary of the chief events of each reign in chronological order, and then to select some prominent event, or the life of some great personage, for full and graphic description. The plan has been well carried out, the summaries are concise and clear, and the lessons most interesting. The volume is issued in the best style of the publishers, with maps, illustrations, notes, lists of events and words complete. We are of opinion that it is more suitable as a reading-book than for the purpose of class-subject-teaching, and for this end it has our hearty good wishes and approval.

The Advanced History of England. London: T. Nelson and Sons, Paternoster Row.

This volume is the last of the series of histories, of which the 'Intermediate History,' already noticed, is the third. It is designed on the same lines as the preceding volume, but is written in more difficult language, being intended for use in Standards VI. and VII. The earlier history of the country is much more fully treated, and the whole narrative has been built up on a constitutional framework, it being intended to familiarise the readers with the various stages of the growth of that form of government whose blessings we now enjoy. Portraits of the chief historic personages of the last hundred years have been added, and maps are used wherever necessary to illustrate the lessons. The book is too large for one year's use, but is so designed as to cover a two years'

course, and it contains sufficient matter to satisfy the requirements of the Code for that time. The 'Advanced History' is in every way on a par with the other publications of this well-known firm.

A Practical Guide to German Conversation.

Part II. By Carl Gengnagel, Ph.D. London: Simpkin, Marshall and Co.

Part II. of Dr. Gengnagel's 'Conversations' is devoted to a study of the regular verb, and the rules are, for the most part, given with laudable simplicity. The leaving of the sentences in what Dr. Gengnagel calls a 'liquid state'—*i.e.*, capable of constant modification and variation—is a very happy idea.

Some experience in the teaching of languages has, however, convinced us that the only really practical method of making pupils familiar with a foreign tongue is to read the best authors in that tongue with them, even at the beginning, when every word has to be explained by the teacher or looked out in a dictionary; to allow only the translation *into* the familiar language until they can speak and read fluently the language to be learnt; to insist on constant learning by heart, not merely words, but sentences, poems, and even whole stories; to avoid all save the most necessary grammatical explanations (for example, declensions, and conjugations of verbs); and to converse with them about the book read, or on any topic likely to be of interest. An able teacher will always succeed in making his pupils *try* to speak, and in languages, above all other things, '*ce n'est que le premier pas* (or rather *mot*) *qui coûte*. But as this method requires, not only a thorough knowledge of the language taught, but also involves far more trouble than the ordinary correcting of exercises, it is not likely to be very widely adopted at present. Meantime, Dr. Gengnagel's 'Conversations' will prove a sort of compromise. His 'Conversations'—which, happily, do not call upon students to solve the intricate relationships of their 'uncle's brother's cousin's sister' to their 'mother's aunt's daughter's niece,' or the connection between their own 'penknives' and the 'hats' or 'gardens' of relatives—will be especially valuable if used together with the very excellent 'German Grammar' of Clemens Schlomka, and will be exceedingly useful in class-teaching.

Second Annual Report of the Metropolitan Public Gardens, Boulevard, and Playground Association, 1884.

Reports of societies are, as a rule, not particularly interesting or amusing; but to this rule the above report is an exception. Its account of the good work done by the association, with its lists of all the 'open spaces' already laid out, or still to be made use of, and the remarks on the 'success of the experiments,' etc., are full of the most instructive information. The object of the association is to supply 'one of the most pressing wants within the metropolitan area, namely, to provide breathing and resting-places for the old, and playgrounds for the young, in the midst of densely populated localities, especially in the east and south of London;' . . . . 'to endeavour to secure, for purposes of health and recreation, available plots of ground; to obtain the right of laying out, and planting and seating, all disused burial-grounds, waste places, and enclosed spaces.' The various spaces thus obtained are, according to circumstances, laid out as gardens or playgrounds, or occasionally as both of these combined.

In its report the association calls upon all who doubt the value of their work to visit 'on any day, and at any hour, some of the few open places available in the midst of sordid and over-crowded neighbourhoods; and it will be seen that 'these merciful retreats are in constant use and thoroughly appreciated.' For example, the one playground alone on the site of Horsemonger Lane Gaol, is, on the average, attended daily by 2000 children; and it is most remarkable that but two caretakers are required to look after the swings, see-saws, and simple gymnastic appliances, that in six months no single accident had occurred, and that 'the most perfect order has been maintained.' Indeed, it is very interesting to see that, in the long list appended to the report of the various spaces now open, but one single complaint has been made of bad conduct. As a rule, the children, even if very rough at first, soon learn to behave admirably, although frequently left without any supervision whatever; the shrubs and flowers are not damaged; no attempts are made to spoil either gymnastic apparatus or seats. This is assuredly a strong argument against those selfish persons who refuse to open their squares to the general public on the plea that the flowers and trees would be destroyed. The admirable behaviour of children and adults in the most crowded, rough, and miserable parts of London is a direct contradiction to this assertion. Miss J. M. Gladstone supplies a very interesting list of the burial-grounds in London. There are 404 such grounds. Of these 41 are open to the public as gardens; 27 are private property; 8 are offered as building sites; 97 have been built over, or are otherwise lost to the public; 21 are still used as burial-grounds, and 210 still remain unbuilt over, closed for burial, and closed to the public. It is to the preservation and throwing open of these 210 closed burial-grounds and the 8 offered for building purposes that the chief efforts of the association will now be directed. It would certainly be difficult to find a better cause than that of this association, or one that could appeal more earnestly to men of all shades of opinion for help. With the comparatively small sums subscribed so far an immense amount of good work has been done. We sincerely hope that larger contributions will be made during the present year.

Notes on Elementary Physiography.

By William S. Furneaux. London: Thomas Murby.

However brief notes are, they ought to be accurate. Those of Mr. Furneaux are not very brief (they extend over more than 150 pages), and they are even less accurate. They follow closely the order, that is really disorder, of the Science and Art syllabus, without even a protest against the want of system in that Governmental production, and they follow afar off the teaching of Professor Huxley in his 'Physiography'—a book that always seems to us the result of good intentions that are never completely carried out. When we have said this, and stated that the book has one or two useful tables, and that Mr. Furneaux shows a wise boldness in stating clearly, on page 38, the objections to the commonly received theory of central terrestrial fluidity, we are at the end of our tether as far as laudation is concerned.

The vagueness of the definitions of gravitation (page 9) and cohesion (page 12), and the omission of all reference to adhesion, are objectionable. The definition of gravitation does not bring out with *sufficient* clearness the fact that this form of attraction works through great distances. The definition of cohesion does not exclude adhesion; but as the syllabus most unfortunately does, Mr. Furneaux is, we presume, satisfied.

There are several slips in the book—some due to want of care merely, others of a more serious nature. On page 11 it is stated that 'a pound weight at the equator would therefore weigh a little more than a pound at either pole'—a statement exactly the reverse of the truth. The word 'kinetic,' on page 15, is introduced without either derivation or definition. On page 24 the summing-up of the correlation of the physical forces seems incomplete without the mention of the name of Grove. On pages 29 and 31 are two different formulæ for water. On page 54 we have the 'class foraminifera,' for the order or sub-order Foraminifera. The map of the Gulf Stream (page 83) should have the name of something besides the equator given. And finally, we are sure Mr. Furneaux never tried the experiment of making sulphur crystals by the cooling method, or he would not give the direction, 'break a hole' in the crust. If two holes are not made, the

external pressure of the air prevents any outflow of the liquid sulphur. 'Permian,' on page 139, has become 'Premian.'

Worse than all these, however, are the actual and unpardonable blunders. In the third paragraph of the book, weight is confused with mass. If, on the Furneauxian supposition, there were only two bodies in space, they would certainly have mass or quantity of matter, but equally certainly they would have no weight, a quality due to the attraction of the earth, which, *ex hypothesi*, does not exist. To make our assurance of his blunder doubly sure, in paragraph 5, Mr. Furneaux writes: 'Each moving through a distance inversely proportional to its mass or weight.' In the study of varying weights of the same body (whose mass is constant nevertheless), at pole and equator, no notice whatever is taken of centrifugal force, which plays a part at least as important as the different distances from the earth's centre. Page 16, 'All substances expand on being heated.' Has Mr. Furneaux ever heard of india-rubber, or silver iodide? Page 17, 'Ice is the crystalline form of water.' Ice is not crystalline. Page 102, 'The thermometer . . . shows . . . the degree of heat.' A thermometer registers degrees of temperature. That this is no mere slip is shown on page 105: 'Evaporation is proportional to the degree of heat.' Evaporation is proportional to the degree of temperature. Chemical errors abound. Page 13, Mr. Furneaux is apparently ignorant of the fact that six sulphides of copper exist. All compounds are named on old-fashioned models. Thus, aluminium silicate is mis-called silicate of alumina (page 44). P^2O^5 is said to be the formula of phosphoric acid (page 90). As a crowning error, of magnitude sufficient to warrant the non-writing of a work on Physiography by him that commits it, take that on page 14, where, as an example of the production of heat when two substances *combine* chemically, the *mixture* of water and sulphuric acid is given.

First Lessons in English Grammar. By S. E. Querini. London: Wyman and Sons.

If without any very positive virtue, Mr.—or should we say Signor?—Querini's little book has at least the negative one of not being nearly as bad as it might be, or as many such 'first lessons' are. We must, however, take exception to his statement that 'grammar is not a favourite subject with a child, or one that his mind can easily grasp.' On the contrary, grammar well taught is a subject in which even the smallest children become intensely interested, and which, if the teacher's 'exposition hath been sound,' their minds grasp most readily. We have known a really able teacher make the generally dreaded grammar class the most popular of all the lessons.

We have said that Mr. Querini's booklet might be much worse than it is. He might, should it reach a second edition, make it much better if he would correct certain errors into which he has fallen. We point out a few of these. On page 1 Mr. Querini defines a noun as 'the name of every animal, place, idea, and thing.' Had he defined it simply as the name of any thing, he would have been both more concise and more correct. Animals, places, ideas, are things. The enunciation of some few of the many different kinds of things is, therefore, mere tautology. On page 7 Mr. Querini gives the cases in English as nominative, vocative, possessive or genitive, objective or accusative. But if the vocative case is given, then surely the dative should be given also; and in stating that the objective *answers* to the dative Mr. Querini falls into the very common blunder of mistaking the sign for the thing symbolised. This same sign has, in English, to do duty in three cases: the accusative, dative, and ablative, and, so far as nouns are concerned, even the nominative and vocative. For example, in the three sentences, 'he hit the boy,' 'he gave it to the boy,' 'he took it from the boy,' the form 'boy' remains unchanged, but its cases are entirely different. We note also that Mr. Querini ignores the word 'the' altogether. It is not a word whose position is easily made clear to children, though they always want to know 'what the is'; but it should come under the heading of demonstrative adjectives. In dealing with conjunctions Mr. Querini tells us they 'join sentences.' But they do more; they join *parts* of sentences also. If Mr. Querini in future editions of his grammar will correct these slight errors his little work may prove of some use with young children.

English History in Rhyme. By an M.A. of Cambridge. London: John Heywood.

'There is nothing fixed in the memory so easily and indelibly as poetry,' says the M.A. of Cambridge in his Preface, and he writes a 'history in rhyme,' thereby implying that his 'rhyme' is poetry. We do not know which is the more remarkable: that a man in his senses should write such vile trash; that any one should consent to publish it; or that any one would willingly buy it. To teach little children such a farrago of nonsense is simply cruel, and we see with astonishment and regret that the M.A.'s 'History' has reached a second edition. Is there no 'society' that will protect children from such cruelty? Rhymes like this M.A.'s are enough to spoil any child's ear for the music of our language, and to disgust it once for all with history and poetry. That no one may accuse us of being unduly severe, we will give a few specimens of the 'poetry' an M.A. hopes to fix 'easily and indelibly on the memory' of children. Our specimens are taken quite at random—

'We know but little of Ancient Britain,
Because there is only little written. . . .
By Hadrian was built the mighty wall,
Which still we trace, and Roman still we call. . . .
Above the cloud of battle and of war,
The name of Arthur rises like a star. . . .
The seventh century had now drawn nearer;
The Saxon Heptarchy was in this era. . . .
O God, protect this land of liberty,
The home of the great, the good, and the free;
Bless Thou our monarch, make her reign supreme,
Hear our supplication, "God save the Queen!"'

We are sure our readers have by this time had quite enough of the M.A.'s poetry. Our excuse for inflicting even so much upon them, as for noticing such work at all, is our desire to protest in the name of our children and our language against tormenting the one and perverting the other by such a volume. The M.A. gives but one sign that he has any conscience left. He has remained anonymous.

A Grammar for Beginners. By E. Bartrop. London: Thomas Laurie, Paternoster Row.

This is only a little book, but it is about the worst specimen of a book that has ever come into our hands. Anybody nowadays seems to think it possible to write a work on grammar; and so we have books like the one under notice, which is so bad that we venture to say there is not a carefully-trained pupil-teacher in the kingdom who could not have produced a better.

Of the definitions of the eight parts of speech, six are incorrect, and nearly every page is bristling with some grammatical or other mistake. To illustrate what we mean, take the following sentences, picked at random from various pages:—'Grammar teaches us how to speak correctly;' 'An adjective is a word which tells you what sort or kind of thing' (If the latter is a specimen of the correct speaking the author has learned from grammar he can hardly be thought a safe guide for others); 'Tell me some verbs, and why;' 'Five of the parts of speech have *inflections*—that is, a *change* in the end of the word;' 'Boy is singular, because there is only one;' 'Verbs are the most important part of speech;' 'I like John and he likes me is a co-ordinate conjunction.'

The definitions which, with exercises upon them, form the chief part of the work, are strangely defective. We have already given the definition of the adjective in one of the preceding sentences. 'A noun is the name of anything you can see, hear, or feel.' Here we have no

reference to that large class of nouns generally called *abstract*, many of which are the names of things which we neither see, hear, nor feel. Immediately after stating that a noun is only 'the *name* of any thing,' an exercise is given in which the pupils are asked to 'write down six things you can see.' The definition of a verb excludes all reference to 'being'; and in the short cuts for finding to what parts of speech words belong, equally strange errors are made. 'A preposition is a *little* word, etc.'; 'A preposition can always be told by putting "them" after it.' In the sentences 'I brought them,' 'he caught them,' by the above method, *brought* and *caught* might be prepositions. And of a preposition we are further told, 'if it is not followed by a noun or pronoun, it is an adverb.' So in all sentences which allow of a conclusion with a preposition, as 'What are you thinking about?' the preposition is an adverb, for there is no qualification to this statement whatever!

We need not quote further. Grammar is difficult enough for children without compelling them to unlearn in future years what is now put before them, and every endeavour to simplify it at the expense of accuracy should be scrupulously avoided. This book does not simplify without the perpetration of serious mistakes.

Graduated Arithmetic on a New Plan. Parts I., II., III. By E. H. Thrower. London: Thomas Laurie, 12, Stationers' Hall Court.

These books are supposed to be prepared for Standards I., II., and III., and the title-page says they are 'on a new plan.' We have gone very carefully through them, and have come to the conclusion that the books have been prepared for children born with faculties similar to those of the 'calculating boy,' the record of whose feats amazed us so much in our younger days. Here is a mental arithmetic sum for Standard I. children, who have just been introduced to 'tens.'—'I sold 9 bullocks for £25, £37, £15, £49, £27, £34, £48, £16, £43; what money did they bring me?' and, another in subtraction, 'In a box were 89 oranges, 37 were spoiled, I sold 42, and gave Tom the rest; how many had Tom?' The author must have been out of the country, or is not at all conversant with the fact that codes change every year, for at the head of each book we have the work of the standard quoted from the code of 1878! So as test sums for Standard I. we have addition sums of nine lines, with numbers up to thousands; and in Standard II., the test sums have numbers up to tens of millions.

To call the 'Arithmetic' 'graduated' is a sad misnomer. The book for Standard III. opens with 200 exercises in long division, the first of which is by 89! Where is the practical teacher who would attempt to begin long division with such a number? Twelve examples with a divisor of two figures, and eighteen with three figures, are considered sufficient, and the remaining 170 have divisors of four, five, and six figures. We need only mention that the first example in compound addition consists of *ten* lines, with tens of millions of pounds, and all the difficulties of shillings, pence, and farthings, to show how little graduation there is in the book. Compound subtraction begins with an equally absurd sum, and is quite as difficult as the last of one hundred examples. The questions in words, and the problems which the author calls 'exercises' are very little better than the examples in figures.

Standard III. must know the whole of the Weights and Measures Tables thoroughly, in order to answer such questions as 'How many tons in .... lbs.?' 'How many cubic feet in .... cubic inches?' 'What number of miles is equal to ... feet?'

We have failed to find out what the 'new plan' of the book is, and the examples quoted above are sufficient to show how little reason there is for calling the book 'graduated.'

Instead of proving attractive, and an incentive to children, these books will assuredly repel, and prove a bane and a weariness of the flesh to any teacher who may use them. The type is small, but the printing is good.

The 'Try' Arithmetic. Answers to the 'Try' Arithmetic. By Dennis Heywood. Manchester: John Heywood, Deansgate.

The 'Try' Arithmetic is a book of arithmetical examples for use in the Seven Standards. It is clearly printed, and very strongly and neatly bound. It is also issued in six parts, the last of the parts having to serve for both Sixth and Seventh Standards. The work of each part is divided into four sections, to correspond with the four quarters of the year. The examples in the various sections are arranged in groups of four, six, or eight, under the twenty-six letters of the alphabet, to facilitate reference, and to ensure ease in setting home lessons. The work of the first and second quarters is mechanical, that of the third consists of problems, and that of the fourth of inspectors' tests. The graduation of the examples has been carefully performed. The author says, that the preparation of the Arithmetic has been a long and laborious task. We can well believe him, when so many thousands of examples had to be constructed to fit the easy method of testing which has been adopted. But, notwithstanding the length and difficulty of the work, we are of opinion that he should have carried it through when once begun, and that there should be no necessity for such a note as the following prefixed to the work of Standard VII.:—

'Definitions and rules in Standard VII. are omitted, for want of space. The pupil is recommended to study the definitions and rules as laid down and explained by Barnard Smith, Colenso, or Melrose.'

Scholars who are able to do this will have no need of the few examples (240) provided in the pages devoted to this important standard. The value of the work as a complete manual is marred by the want of examples in the various rules required by the children of Standard VII. With this exception, the 'Try' Arithmetic, which is well and carefully got up, can be cordially recommended to teachers in every respect.

The Shilling Geography. By Dr. Chas. Morrison, M.A. London: Simpkin, Marshall and Co.

Some time ago we had an opportunity of reviewing Dr. Morrison's larger work, 'The Historical School Geography,' and of giving to it our warm approval. The 'Shilling Geography' is prepared upon the same plan; and into the space of 128 pages, the author has compressed as much geographical knowledge as is consistent with clearness. Where conciseness and completeness are required, it is almost a matter of course that the pages should be crowded with names, but Dr. Morrison has managed to interweave so many items of useful information that the book is as interesting as can be expected. The 'Shilling Geography' may be used as a text-book for the junior classes of middle-class schools, or in conjunction with the geographical reading-books of elementary schools. In either case it will be found sufficient, as well as eminently suitable, for a good grounding in this necessary subject of education.

(*a*) Story after Story. (*b*) Cheerful Sundays. By the Author of 'Sunday Evenings with my Children.' London: Hodder and Stoughton, 27, Paternoster Row.

No more suitable books for presents to little folks could be found than the two volumes with the above titles. Every page is interesting, and the illustrations, by many of our most eminent artists, are all that could be desired. No parent will find a difficulty in answering the question, 'How shall I make the Sunday evening pass pleasantly for my children?' if he has at hand either of the above books, for each of the stories teaches its own lesson of truth or kindness, or some other virtue. The volumes are got up in the publishers' best style.

A Star in the Crown: A Story of School-boy Life. By Daniel Darlinghurst. London: Jarrold and Sons, 3, Paternoster Buildings.

This is a short story of some events which are supposed

to have happened in a boy's life at a boarding-school. It is meant to teach that a consistent Christian life, even if it be that of a boy, will produce an effect on those with whom it is brought into contact. The story is fairly well told, but is not such as we should care to put into the hands of our elementary school children. 'Bessemer Bob,' the story of a boy who worked in a steel-works, and who resisted all attempts to entice him into wrong-doing, we like much better.

Quarterly Arithmetical Tests. Standards II. to VII. London: Longmans, Green and Co.

Three copies of each of eight cards make up a packet. On each card are four sets of questions to serve as tests for the four quarters of the year. The cards are very varied, but the sums are difficult—in our opinion, too difficult for the majority of schools. The fourth quarter's tests are considerably easier than many of the examples in the previous quarters. A card of correct answers accompanies each packet. If a child can work easily and correctly these cards, there will be no fear of his being able to attack the most difficult card set by any of Her Majesty's Inspectors.

Sixth Natural History Reader. By the Rev. J. G. Wood, M.A. London: Isbister.

The principles of variation and artificial selection seem to be at work in regard to our educational literature as in all other domains. Evolution has been at work; the Kirbys and Spences have been replaced by the Huxleys, and after reading the Sixth Natural History Reader, we are inclined to say that the Woods will have to give way to the Grant Allens. Mr. Wood has so long been the friend of our youth (we use the word 'our' in a reviewer's sense), that we regret to have to criticise adversely this little volume. It is very interesting, with its clear descriptions of animals, its charming manner, its ingenious comparisons (note that of the Ascidian, p. 68), its history of devices for the capture of lower animals, its details on the economics of natural history, its diverting diversions into the realms of sociology. But there are too many instances of carelessness and of actual mistakes for a work bearing the name of J. G. Wood. 'Scientific' grammar, with uncertain 'it's' and vague commas, is again painfully to the fore. Technical words are mentioned on one page and explained on a later one. 'Bivalve,' *e.g.*, appears on p. 30, and is defined on p. 45. 'Cilia' appears on p. 43, and is defined on p. 46. Here followeth a list of blunders in zoology, quite unpardonable in a book of this kind. The brain is said to be 'to the nerves what the heart is to the arteries and veins' (p. 3). Neither anatomically, physiologically, nor ontogenetically does the parallelism obtain. The large claws next to the head in the lobster are not the 'jaw feet,' as they are most improperly called on p. 79. The 'large claws' or chelate limbs are not feet-jaws. The feet-jaws or maxillipedes are in front of and below them. On p. 48, the legs of insects are said to be 'formed in much the same manner as our own.' A more dangerous statement is hardly conceivable. Six pages later, insects are denied the possession of heart and brain. But the dorsal vessel is clearly a heart, and is so named in Huxley's 'Invertebrata,' p. 412; and the supra-œsophageal ganglia are and ought to be called a brain (l.c., p. 415). In this same class of Insecta, generally a stumblingblock to Mr. Wood, the ventral sinus is altogether ignored, and the statement is actually made that there are 'no ears which we can find.' Twenty-one years ago, Von Siebold demonstrated ears in the thorax of the grasshopper and in the legs of the crickets and locusts [*Archiven für Naturgeschichte*]. The pedicels and acetabula of the ambulacral system of the star-fish are called 'tentacles' (p. 200), a name only applicable to tactile organs. The phrase coral 'insect' is used on p. 208.

Nor is Mr. Wood's classification free from blame. It is often old-fashioned and sometimes inaccurate. Tunicata for Ascidioida (the more remarkable as in the very next class he discards the older name Bryozoa for its modern equivalent Polyzoa), and Anthozoa for Actinozoa are instances of the former weakness. Some of the inaccuracies are the placing Mollusca higher as a sub-kingdom than the ringed sub-kingdom, a general error made special on p. 71 by the statement that the sea-mat ranks above the lobster; the placing all worms under the Annelida, p. 191 (has Mr. Wood ever heard of the group Vermes or the class Scolecida?); the placing leeches and earthworms in the same family (p. 195); and the terribly misleading statement that the sponges are Protozoa, a statement almost as out of date to-day as if one said they were plants.

We cannot, finally, congratulate Mr. Wood on the treatment of the moral question in his Reader. The cruel side of Nature is delicately but, as we think, unwisely veiled. Further to say that all creatures 'render some service to the world' is not true, even of the animals described here. The 'ticks' of p. 43, and yet more the whole series of parasitic animals, from lice to tape-worms, are of no known service to the world, but only increase the sum of its misery.

Hygiene. By Albert Carey. London: T. Murby, Ludgate Circus Buildings.

One of the interminable series of little volumes issued 'to meet the requirements' of that bookmaker, the Science and Art Department. Mr. Carey has the wisdom to see that the syllabus in hygiene is illogical in order, and the courage to re-arrange it. He does not insert any of the questions set in past years, but he has a glossary of only 36 terms, containing one or two doubtful derivations. Mr. Carey's style is not wholly free from a suspicion of 'high falutin'' in places, and there are many mistakes in his work. The discovery that the nitrogenous and non-nitrogenous food-stuffs overlap one the other functionally is hardly a 'recent' one (p. 10, note). 'Chlorin' (p. 152) is usually spelt with a final 'e,' and 'caseine' (p. 21) is not. 'Ozmazome' (p. 12) and 'osmazome' (p. 152) are likely to confuse the student. There is no such thing as an 'itch *insect*' (p. 106). Albumen is by no means identical with the serum of the blood (p. 11); it is only one of many constituents of the serum, along with water, fats, salts, colour matters, odoriferous matters. Cholesterin is not a fat (p. 12); it is a monad alcohol, homologous with cinnyl alcohol. Swallowing is not 'of a purely reflex nature' (p. 34). The act, like the First Gravedigger's, 'hath three branches' or stages, of which the last only is 'purely reflex.' The common confusion of heat and temperature, that we are really weary of noticing, occurs on p. 13. Some diet tables are useful; but the best things in the book are the quotations.

Hygiene. By Thomas London. London: Chambers.

This also 'meets requirements,' and prints the syllabus; but Mr. London follows the syllabus in order of treatment. He has questions at the end of the book, and a very good glossary of 97 terms. His work is better in matter and in manner than the one just noticed. As to manner, his style is light, without flippancy, and varied with an occasional anecdote quite *à propos* to the subject in hand. His food descriptions make one feel hungry; and the general impression left is like that given by the study of human anatomy and physiology, that one knows uncomfortably too much. Mr. London wisely lays under contribution Drs. Parkes and Edward Smith and others. He bravely writes 'carbon dioxide' for the misleading 'carbonic acid.' He makes clear (p. 21) the way in which phosphorus enters the body. He effects a compromise in the matter of thermometric scales by using both the Fahrenheit and the Centigrade. His contributions to the vexed questions of alcohol and vegetarianism are thoughtful and temperate. This is the more remarkable, as upon both these matters opinions are as diverse and as bitter in expression as those on vaccination. We are tempted

to quote from pp. 45, 46 a few lines :—'The question whether it be possible to dispense with animal food, and live on vegetable material alone, has been much debated of late. Certain it is that health can be maintained for a long time on vegetable food. The subject, however, is largely a question of climate. Animal food has in its favour that it is more convenient, concentrated, and piquant, and that it usually comprises in itself the various kinds of food needed, without the disadvantage of great bulk. All medical men are agreed that animal food is indulged in by most people to excess, and that it would be a positive advantage to the health of the community to use more vegetable food than at present.'

In future editions, which ought to be needed, Mr. London might note that the order of his three food-stuffs (p. 9) should be reversed; that 'carbonate of lime' and like names are old-fashioned enough to be inaccurate; that the formula of starch is $(C^6H^{10}O^5)_n$, not $C^6H^{10}O^5$; that 'glycolate' (p. 17) should be 'glycocholate'; that the round worm is not '*Lumbricus*' (p. 1), but '*Ascaris lumbricoides*.' He and writers on hygiene generally would do well to point out the chemical identity of caffein, the alkaloid of coffee, and thein, that of tea, and to note that the same alkaloid also occurs in *maté*, or Paraguay tea. To show how thoroughly, on the whole, the work is done, we may state that Koch's supposed comma-shaped cholera bacilli are noticed (p. 84). The book was out before the refutation of Koch by Dr. Lewis and Professor Ray Lankester had taken place.

Principles of Agriculture. London: Blackie and Son.

This volume starts with a somewhat doubtful definition. A hypercritic is hardly needed to enter some objection against the definition of agriculture as 'the art of cultivating or tilling the land, so as to make it produce the *greatest quantity* of plants useful to man.' The English is faulty here and there (pp. 21, 49), and, not unnaturally, the Latin and Greek derivations are not in all cases quite accurate (pp. 24, 103). 'Pistil' for 'gynœcium,' the 'order' fungi (p. 136), and the statement, on p. 6 (repeated on p. 102), that a leaf is *a* layer of cells are slips or worse. Other botanical shortcomings are to be found in the complete ignorance (p. 7) of the fact that in many seeds nourishment is stored up within, and not outside, the embryo, and the speaking (p. 76) of spores and seeds as convertible terms. The chemistry is very weak: this appears to be inevitable in all the text-books on subjects only indirectly related to that science. Chlorine combines with potash, not potassium; clay is a compound of silica and alumina; and on pp. 85—87 occur five diagrams purporting to explain the structure of phosphates. Doubtless they are well intentioned, but they seem to us of a most dangerous nature. The little book has, nevertheless, some good points. The practical method of demonstrating osmosis (p. 10), the reference to Darwin's experiments and calculations on earthworms and soil (p. 33), and to cross-fertilisation (p. 108), and the paragraph on ensilage, are instances of the author's care and acquaintance with the best and most recent literature. The summary of, and questions on, what has been done, at regular intervals, are good in idea and in execution.

German School Classics. I. Meister Martin: Von E. T. A. Hoffmann. Edited, with Literary Introduction and Notes, by Franz Lange, Ph.D. Symons and Co.

It is impossible to praise too warmly this thoroughly admirable little book, indisputably the best of its kind that we have seen. We do not know to whom it will be more welcome—to the taught, who are weary of dull and hacknied selections from Gœthe and Schiller, or to the teachers, who are as weary of these selections—always the same ill-chosen ones—as their pupils, and to whom, moreover, it is painful to see a distaste for Germany's greatest writer carefully instilled into young pupils by the enforced study of portions of his great works. We speak of this volume, not only from the critic's point of view, but also from that of a teacher. We have for a long time been convinced of the uselessness of most 'German Readers,' and have given to pupils works like those of Hoffmann instead. But as only ordinary German editions were obtainable, the difficulties of the students and the work of the teacher were necessarily much increased. This 'series' of Dr. Lange's—we do not know if all the volumes issued by him are as good as the one in question—should do away with all these difficulties, and provide that which we are sure every practical teacher has 'longed long' to possess—an interesting and beautifully-told story, with notes that are well-nigh perfect.

To begin with, the choice of 'Meister Martin' from the innumerable works of Hoffmann is, for this particular purpose, a singularly happy one. It is a perfect example of one side of Hoffmann's genius. It is also a charming story, full of delicate observation and of subtle insight, not only into the nature of men and women, but into the conditions of a society where the guild was still a power. Of course, 'Meister Martin' is characteristic of only one side—and that, perhaps, the least known—of the many-sided Hoffmann, a writer in whom we find the weird power of Poe united to the bitter satire of Swift, the humour of Dickens, the delicate fancy of Lamb. Those who wish to understand why this strange genius came to make so deep an impress on the literature, not only of Germany but of France, why even men of such original talent as Soulié and such profound genius as Balzac were influenced by him, must study, not 'Meister Martin,' but such books as 'Das Majorat,' 'Die Elixire des Teufels,' 'Kater Murr,' 'Klein Zaches,' 'Der Goldene Topf,' 'Doge und Dogeresse.' These are more than 'weird tales,' as Dr. Lange calls them: they are among the profoundest studies of human nature, the bitterest satires ever written.

Dr. Lange's introduction, with his biographical sketch of Hoffmann, and short critique of 'Meister Martin,' is very good—so good, indeed, that we regret he has not made it longer and fuller. As to the notes, they are, as we have already said, almost perfect. Their number, manner, arrangement, are all that could possibly be desired. It seems something like base ingratitude to find any fault whatever with so excellent a little book as this, and if we do, Dr. Lange has only himself to blame; his work is so good that in reading it we become hypercritical. So to our grumble. The translations of various passages quoted from Gœthe are so bad that we cannot believe Dr. Lange is responsible for them. He himself would surely not make Gretchen say: 'I'm neither lady, sir, nor fair, *and guidance home would needless be*.' We must also take exception to his renderings of 'blendend' by '*shiningly*' ('blendend weiss' is '*dazzlingly* white'); of 'Liebeswahnsinn' ('love-madness') by '*love-fit*'; of 'hervorzurufen' ('to call forth again') by '*to produce* again'; of 'an Rosa war gar nicht *gedacht*' ('of Rosa there was no thought') by 'there was no *mention* of Rosa'; of 'Friedrich lebte ganz auf' ('Friedrich quite revived') by 'Friedrich *found his young spirits again*'; of 'es gebricht mir an arbeitern' ('I am in want, or short of, workmen') by '*I cannot do without more workmen*'; of 'entquollen der Brust die Worte' ('the words welled out from his breast') by 'he *uttered* these words'; of 'ich schaff ihn her' ('I'll get him here') by 'I'll *fetch*,' or '*send for* him'; of 'und zum wurdigen schluss' ('and as a fitting end') by 'and *as a finale*'; of 'geringen Kunstlern' ('lesser artists') by '*mean* artists'; of 'liess sich auf ein knie nieder' ('sank on his knee') by '*bent* a knee'; of 'sich meiner annehmen' ('took me up') by '*patronized* me.' It is, perhaps, also a pity to render 'freien um' (literally, 'to court') by 'sue for,' since the verb *to sue* in English has various meanings. These, it will be seen, are very trivial faults; yet they are the only ones that, after very careful reading, we have been able to discover; and it is pleasant to turn from them to the consideration of the great merits of Dr. Lange's notes. Not the least of these merits is

that they are not, after the wont of such notes, merely didactic and explanatory. They not only convey information that might be gathered equally well from a dictionary or ordinary grammar; they are full of suggestions that will set the student a-thinking and a-working for himself; they contain admirably clear and simple exposition of the idiomatic peculiarities, the delicate niceties of the German language. We hope to see many more volumes edited with equal care and ability by Dr. Lange. They will be invaluable alike to teachers and students.

Publications Received.

Miscellaneous—

The Cornhill Magazine (February).
Letts's Household Magazine (February).

Chambers (W. and R.)—

Wordsworth's Tintern Abbey, etc. With Notes.
Shakspere's Tempest. With Notes. By J. M. D. Meiklejohn, M.A.
Fractional Electricity. By H. C. Tarn, M.C.P.
Chambers's Graduated Readers. Book VI.

Groombridge and Sons—

Factors in Algebra. By Rev. J. G. Easton, M.A.

The National Society's Depository—

Higher Reading Book for Schools and Colleges. By C. M. Yonge.

Bryson, John—

The Scottish Examination Test Cards. Standard IV.

Infield, H. J.—

Infield's Standard Reader. Second Primer.

Pitman, F.—

Schubert's Songs.
Clytie (Waltz). By Mary Ostlere.
Ariadne (Waltz). By Mary Ostlere.

Marcus Ward and Co.—

The Child's First Lesson Book. Geography. By M. J. Barrington Ward, M.A.

Cassell and Co. (Limited)—

First Lessons in German Reading. By Fräulein Jagst.

Wesleyan-Methodist Sunday-School Union—

The Mystery of Grange Drayton
The Secret of Ashton Manor House } By Eliza Kerr.
Two Snowy Christmas Eves
Papers on Sunday-School Teaching. Parts I. and II. By J. Hewitt Tomlin.

Thirde, W. C.—

Twelve Lessons in Model Drawing. By W. C. Thirde.

Blackie and Son—

Blackie's Elementary Text-Books. Algebra. Part III.
Home Lesson Books. Geographical Reader. Nos. 2, 3, and 4.

Longmans and Co.—

School Board Idylls. By J. Runciman.
Longman's Magazine (February and March).

Simpkin, Marshall and Co.—

An Etymological Index to Shakspere's Play of the Tempest. By F. C. Woodforde, B.A.

MANSFORD'S MATHEMATICAL WORKS.

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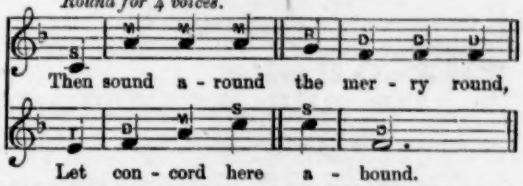

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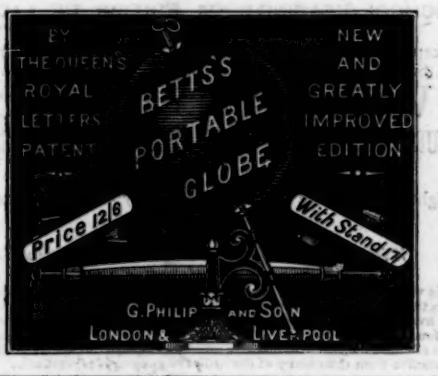

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